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HISTORY

OF THE

BASIC (M31) HONEST JOHN ROCKET SYSTEM (U)

1950—1964

S E C U R I T Y

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Tactical Emplacement of the 762-mm., M31 Honest John Rocket and M289 Self-Propelled Launcher System

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HISTORY
OF THE
BASIC (M31) HONEST JOHN ROCKET SYSTEM (U)
1950—1964

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(U) PREFACE

(U) This historical monograph traces the evolution of the Basic (M31) Honest John Rocket System from its inception in the Korean crisis of 1950 to early 1964. It is one of the monographs in the Missile Command series and the first of two volumes to be published on the Honest John family under AMC Project 7M. The second volume will cover the history of the Improved (M50) Honest John System (1955 - 1964).

(U) The M31 Honest John Rocket System issued to Army Field Artillery units in early 1954 had the signal distinction of being the first U. S. tactical nuclear weapon. Top military planners had recognized the value of such a weapon for battlefield use as early as May 1946, but serious developmental effort did not materialize until the early 1950's. Aside from some research test vehicles such as the V-2, the Viking, and the Hermes, no large-caliber rockets were made in the United States before 1950. Up to that time, American interest in rockets seemed to be split between an academic curiosity in how the Germans had done what they did and a desire to learn more about the upper atmosphere.[1] In short, the United States officially adhered to a conventional evolutionary approach to the development of new weapons, blind to the fact that an era of revolution in technology had already started.

(U) To provide essential background on the crash development of the Honest John, the first chapter of this study includes a rather detailed analysis of the political climate and military doctrine that shaped the national defense policies and programs during the crucial postwar years. The second chapter describes the revised Army plan for top priority development of modern ground combat equipment, including

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[1] For a comprehensive account of Army rocket development during the pre-1950 period, see James W. Bragg, "Development of the Corporal: The Embryo of the Army Missile Program," (2 vols., ABMA, April 1961), I, 1 - 126.

tactical nuclear weapons, and traces the evolution of the Honest John prototype through a series of successful feasibility demonstration firings which culminated in the establishment of a crash development program. The ensuing chapters deal with the implementation of the accelerated program and the development, evaluation, production, and deployment of the final tactical system. The study ends with an appraisal of the overall weapon system and its expected life-span as a member of the Army's family of operational weapons.

(U) An overall cost summary for the Basic and Improved Weapon Systems will be included in the history of the latter, together with consolidated summaries of certain field support activities which could not be readily separated by system without repetition.

(U) Unless otherwise noted, the footnotes are unclassified and the documents cited as sources are located in Historical Division files, AMICOM.

1 April 1964 Mary T. Cagle

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CHAPTER I

PROLOGUE

(U) The Honest John rocket and the impressive array of other rockets and missiles that now grace the American arsenal of operational weapons are the product of a multimillion dollar research effort stretching back over two decades. Basic research in long-range rockets and guided missiles began well before the end of World War II; however, with the dawn of the Atomic Age in 1945, rocket research took a back seat in the national defense budget and remained a minor, almost obscure item throughout the first 5 postwar years. It took the searing threat of a third world war in 1950 to reverse this trend; but even with a substantial budget increase for crash development programs, the first tactical missiles were not ready for field use until after the Korean War ended.

(U) Among these systems was the Honest John rocket, the first atomic weapon carrier of its type to be issued to ground combat forces. Preliminary design work on the Honest John began in the fall of 1950; but full-scale development of the interim emergency weapon did not begin until August 1951. The first tactical system was ready for troop issue early in 1954. The fact that the Ordnance Corps developed the Honest John, using essentially off-the-shelf hardware, in a record time of slightly more than 2 years clearly indicates that the weapon could have been made available several years earlier. To place the emergency development of the Honest John system in proper focus and to answer the obvious question of why the program was delayed, it is necessary to review the political and military climate that shaped the national defense program during the postwar period.

(U) A New Strategic Creed

(U) Nuclear weapons began to exert an important influence on U. S. military policy immediately following World War II, although their capabilities, limitations, and political implications were only vaguely understood. The terror and destruction wrought by the two atomic bombs dropped on Japanese cities in August 1945 had left an indelible

impression on the whole world. The most secret and the most daring enterprise of World War II had given the United States a weapon of unparalleled power that would not only revolutionize war but could alter the course of history and civilization. Military strategists were quick to conclude that the air-delivered atomic bomb represented the ultimate weapon which would permit the United States to police the world and keep the peace through the threat of its use. Thus, in 1945 there emerged a new strategic creed, later to be known as massive retaliation.[1]

(U) Convinced that the power of the atom held the key to the security of America and of the free world, President Truman firmly committed himself to the proposition that, as long as international agreement for control of atomic energy could not be reached, the United States had to stay ahead of any possible competitor. "It was my belief," he later wrote, "that, as long as we had the lead in atomic developments, that great force would help us keep the peace."[2] The corollary of this belief was the conviction that the foot soldier and conventional military weapons would have little or no value in wars of the Atomic Age.[3]

(U) Amid the fear and confusion that characterized these early years of the Atomic Age, it was only natural for the United States to rely on air-atomic power as its first line of defense. But the atom bomb, no matter how powerful, by no means eliminated the need for conventional forces.

(U) The Stilwell Board Report

(U) As a result of experience gained in World War II and the astounding revolution in weapon technology, the tactical organization and equipment needs of ground combat forces underwent a number of

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[1] Maxwell D. Taylor, The Uncertain Trumpet (New York, 1960), pp. 4, 12.

[2] Harry S. Truman, Memoirs (2 vols., Garden City, 1955 - 56), II, 306.

[3] Taylor, op. cit., p. 12.

changes, most of them reflecting a trend toward greater emphasis on fire power and mobility. It was with these changes in mind that the War Department Equipment (Stilwell) Board convened early in 1946 to formulate a new policy for equipping the postwar Army.

(U) At the close of the war, scientists were on the verge of many new discoveries and improvements in practically all fields of military equipment. To assure continuation of this effort with proper emphasis, the Stilwell Board recommended the adoption of a procedure whereby scientific research would be accorded a major role in the postwar defense structure. The War Department Chief of Staff approved Part A of the board's report as a "policy document" on 29 May 1946. At the same time, he designated the Director of Research and Development, War Department General Staff, as the implementing authority for Part B, which contained a description of the principal items of equipment to be developed.[4]

(U) Even under ideal conditions, military leaders realized that a long time would be required from the conception of the need for a piece of equipment to its development, test, production, and delivery to the battlefield. The limitations that were sure to be imposed on funds during the postwar period, coupled with the shortage of research talent, dictated the most careful selection of items for development. In general, the program would follow two parallel courses: vigorous research and development of new or anticipated types of equipment, and continued improvement of existing equipment as an interim measure. Initially, the bulk of funds allotted for rockets and guided missiles would be apportioned to basic research.[5]

(U) In the light of subsequent developments, two of the board's 16 recommendations stand out as particularly significant. The board declared:

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[4]War Dept Equipment (Stilwell) Board Report, 29 May 46, pp. i, 3. Redstone Scientific Information Center (RSIC).

[5]Ibid., pp. 4, 47, 49.

That the measures necessary to assure the continuous availability and development of more potent or improved atomic weapons and suitable carriers thereof and the development of defensive measures against atomic weapons be accorded priority over all other National Defense projects.

That a striking force of combined Arms be organized, equipped with the most modern weapons, and trained in all phases of land, airborne, and amphibious operations, with the objective that it be instantly available to meet any military contingency.[6]

Taken at its face value, the phrase, "atomic weapons and suitable carriers thereof" might be interpreted to include both strategic aircraft carrying atomic bombs and tactical weapons such as rockets and guided missiles. But such was not the case. The board concluded that the atomic explosive was not adaptable for use in artillery weapons, such as cannon, but "upon perfection of rockets and guided missiles, may be used in a warhead." With rockets and missiles yet in the early research stage, the achievement of operational atomic weapons for battlefield use necessarily fell in the realm of the distant and somewhat hazy future. Meanwhile, the explosive would be "carried by an aircraft as a bomb" and used principally "against remunerative targets such as cities, vital industrial areas, ports, naval concentrations, and bases."[7]

(U) Priority development of "more potent" atom bombs, of jet-propelled strategic aircraft, and of countermeasures against surprise attack thus emerged as the keystone of the national defense policy. The board reported:

. . . The best defense appears to be to convince the entire population of enemy countries that this country is prepared to retaliate immediately on any aggressor, and will answer any unprovoked attack by wholesale devastation produced by atomic bombs, biological agents and lethal gases of great intensity.[8]

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[6] Ibid., p. 8. (Underline indicates italics used in report to denote modifications of the original Stilwell Board Report.)

[7] Ibid., p. 11.

[8] Ibid., p. 11.

Though not made explicit—and, indeed, not even recognized as such at that time—this, in essence, was the nuclear deterrent or massive retaliation policy that was to rule the national defense effort for years to come.

(U) If the Stilwell Board obviously favored a strong, nuclear air power as the first line of defense, it also recognized the necessity for maintaining an immediately available ground combat force. Regardless of the damage that might be done by retaliatory means, the ultimate military decision would depend upon occupation of the hostile territory. To do this, and to carry out the Army's peacetime mission at home and abroad, a well-equipped ground force would be essential.

(U) To fulfill the registered requirements of the Army Ground Forces, a family of free rockets and guided missiles was to be developed for a wide variety of offensive and defensive missions. Requirements for guided missiles embraced seven different systems with varying range and performance capabilities. The board emphasized the urgent need for development of guided interceptor missiles, but warned that such missiles should not be used "as an argument for neglecting ground combat equipment."[9]

(U) Free (unguided) rockets of light artillery caliber for use on the battlefield were already an accomplished fact; however, the short range and large dispersion of these rockets limited their use to that of performing conventional military tasks. To meet new requirements of the Field Artillery and Infantry, improved rockets with greater accuracy and range would have to be developed. Realizing that these improvements could not be achieved within the current state of rocket technology, the board recommended that the initial effort be confined to an intensive basic research program leading to the development of three basic types of rockets: Bazooka, Special Purpose, and Field Artillery. Included in the latter category were three mortar or bomb-type rockets to provide short-range, all-weather support comparable to close-in air bombardment;

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[9] Ibid., p. 12.

and three gun-type rockets with maximum ranges of 13,000, 25,000, and 45,000 yards, respectively, to supplement field artillery cannon. Because of "the relatively lower outlay of funds involved for a small caliber rocket," the board recommended that priority of development be accorded the smallest of the six rockets; namely, the 13,000-yard gun-type rocket with a payload or warhead weight of 30 - 35 pounds.[10]

(U) The development of a large-caliber rocket capable of supplementing conventional artillery in the field of "super-heavy weapons" appeared to be "probable within the predictable future." However, since there was considerable doubt that the desired accuracy and flexibility could be obtained with such a large unguided rocket, the board recommended a back-up program to obtain data and experience with some very heavy artillery weapons.[11]

(U) In summary, the ultimate objective of the Stilwell Board's equipment guide of May 1946 was to provide the Army with an effective striking force of combined arms for prompt and sustained combat operations. It emphasized the vital role of scientific research in the postwar defense structure; outlined the items of new equipment to be developed; and established relative levels of National Defense priority relating thereto. It repeatedly stressed the necessity of maintaining immediately available ground forces and warned that the revolutionary

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[10] Ibid., p. 47.

[11] (1) Ibid., p. 12. (2) It might be noted here that the skepticism surrounding development of an acceptable large-caliber rocket persisted through the early design studies of the 762-mm. Honest John Rocket in 1950 - 51. With reference to the board's assumption that atomic explosive was not adaptable for use in artillery weapons, it might also be noted that a 280-mm. atomic cannon was later developed and issued to Army troops in 1953. This super-heavy artillery gun could fire an atomic shell up to 18 miles with great accuracy; but it was too unwieldy to be entirely satisfactory, being 85 feet long and weighing 50 tons in firing position or 86 tons on transporters. See Maj Marvin L. Worley, Jr., New Developments in Army Weapons, Tactics, Organization, and Equipment (2d Ed; Harrisburg, 1959), p. 17; and Reserve Officers Training Corps Manual (ROTCM) 145-20, American Military History, 1607 - 1958, 17 Jul 59, p. 522. The latter hereafter briefly cited as ROTCM 145-20.

super-weapons would not preclude the need for conventional ground combat equipment.

(U) The military requirements for an adequate peacetime army had thus been defined and approved. The big problem now was to sell this radically new peacetime program to a traditionally complacement Congress.

(U) Postwar Retrenchment

(U) Large military budgets, constant military readiness, and long-range planning for war were still as alien to the American way of life in 1945 as in 1918. But the tragic experience following World War I, coupled with the grim prospects of war in the Atomic Age, clearly showed that the United States could no longer take its freedom for granted. For the first time in its history, the country faced the problem of financing a peacetime defense effort. To meet these obligations, the people would have to support a much larger defense budget, and more importantly, the traditional stampede of citizen-soldiers to civilian life would have to be checked. But with the isolationist bloc in Congress again asserting its influence, and the President himself committed to a fixed ceiling on defense spending, the prospects of achieving these goals were somewhat less than encouraging. Indeed, it has been said that every defense budget in the early postwar years "presented the Joint Chiefs of Staff with a searing moral crisis."[12]

(U) Demobilization

(U) A decade after World War II, former President Harry S. Truman wrote: "No people in history have been known to disengage themselves so quickly from the ways of war."[13] As that war was ending, newspaper editors and politicians alike had announced that this time we would not repeat the 1918 mistake of disarming. Yet, the fighting had hardly ended when public and congressional pressure began to build up for release of service men; and the armed hosts of 1945 were to dissolve

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[12] Walter Millis, Arms and the State (New York 1958), p. 360.

[13] Truman, Memoirs, I, p. 506.

almost as rapidly and wastefully as their predecessors. The combat divisions were inactivated; the huge fleets, including many costly ships which had never seen service, went into mothballs; billions of dollars' worth of planes and equipment were left to rust in the pipelines or disintegrate on storage fields.[14]

(U) The pressure for release of men in the armed services, coupled with drastic fiscal reductions, resulted in a breakdown of planned demobilization and sharply reduced the combat effectiveness of practically every military unit.[15] By the end of June 1946, the Army's strength had been reduced from 8,266,373 to 1,889,690, a decrease of 6,376,683 in the 9-month period that followed the surrender of Japan.[16] From then on, the decline in military strength became more gradual, but the scramble to civilian life during the early postwar months made it necessary to recruit men for the occupation of Japan and Germany. Indiscriminate release of men from the service left units without trained personnel to operate and maintain arms and equipment, with the result that vast amounts of complex, expensive equipment deteriorated.[17]

(U) Strategic and Budgetary Policies

(U) The shameful neglect of conventional military forces could be traced to the unrealistic strategic and fiscal policies which gradually took shape after the war ended. The improvident restrictions on defense spending during these years not only imposed a dangerously low ceiling on military strength, but also prevented the timely development of modern ground combat equipment to replace the outmoded remnants of World War II.

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[14]Walter Millis, Arms and Men (1st Mentor Ed., New York, 1958), p. 272.

[15]ROTCM 145-20, p. 480.

[16]Harry Hansen, Ed, World Almanac and Book of Facts, 1961 (New York 1961), p. 724.

[17]ROTCM 145-20, p. 480.

(U) Signs of retrenchment in defense spending began to appear with the surrender of Germany late in Fiscal Year 1945. The war then ended in the early months of Fiscal Year 1946, and the Truman Administration succeeded in reducing the total defense expenditure for that year to $45 billion. In Fiscal Year 1947—the first full peacetime year—Truman's economy-minded Bureau of the Budget, with the concurrence of Congress, slashed the total defense budget to a meager $14.25 billion.[18]

(U) In many ways, the defense budget for FY 1948 represented the distillation of strategic policies which already were largely accepted though not officially sanctioned by any act of Congress. A year before, most of the huge war surplus of airplanes, combat ships, and weapons had been serviceable; the men were being demobilized, but as far as equipment was concerned, it was chiefly a question of how much to retain out of existing stocks. By late 1947, however, obsolescence had set in and was already far advanced. Despite billions of dollars' worth of weapons left in the pipelines, all the services had to begin thinking seriously about replacement of outmoded equipment. The success of the services in securing appropriations for building new equipment would determine not only their prestige but the authority with which they could speak in the yet undecided strategic and tactical controversies. The whole future of the Army, the Navy, and the newly formed Air Force would turn on the extent of new building allowed them. For the Army's part, of course, this meant a substantial budget increase to speed development of new equipment outlined in the Stilwell Board Report of May 1946.

(U) The Bureau of the Budget, on the other hand, was committed to economy and to the President's concept of a fixed ceiling on defense spending. After the bureau had applied its ax to the service requests, the budget for FY 1948 called for an estimated expenditure of only $11.25 billion—about $3 billion less than that of the preceding year. To keep spending within this ceiling, the Bureau of the Budget refused the Navy its requested super-carrier and cut the Air Force's request

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[18] Millis, Arms and the State, p. 198.

from 70 to 58 full groups. The Army's troop strength was to be still further reduced and it was to get little or nothing to replace obsolete tanks, troop-carriers, and other weapons and vehicles.[19]

(U) But the Eightieth Congress, which the Republicans had captured in the fall elections, was even more deeply committed to economy than the Administration. In the heated debate over the FY 1948 defense budget, very few seemed to recognize that the immediate problem was one of providing an adequate military force to meet the military-political issues with which the country was then confronted. Some felt that to strengthen our military posture would invite war; others, that it was the sure means of averting one. Some wanted to increase aircraft building because it would impress Russia with our power; others argued that this would simply play into Soviet hands by wrecking our own economy. And then there were those whose principal standard seemed to be to spend whatever was required to maintain a prosperous and adequate aircraft and munitions industry.[20]

(U) Amid such conflicting emotions, the treatment which Congress gave the military budget for FY 1948 was the most thorough—and, for the Army, one of the most uncomfortable—in the years since 1933. As Elias Huzar puts it, "Congressmen . . . never explored the connections between military and foreign policies so extensively . . . as they did in 1947."[21] The agonizing dichotomy between the desire to provide adequate defense and the desire to save money in doing so was eventually resolved along two lines. One was the traditional hunt for minor economies—a stricter insistence on justification for each and every item and stern excision of every item which might seem deferrable, regardless of the effect on long-range military plans. The other was to allocate whatever could be allowed for improving the military posture to aircraft production, on the assumption that aircraft represented the

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[19] Ibid., p. 198.

[20] Ibid., pp. 198 - 99.

[21] The Purse and the Sword (Ithaca, 1950), p. 171.

modern and, economically, the most efficient embodiment of military power.[22]

(U) In the end, the congressional changes reduced the Budget Bureau's estimated expenditure for FY 1948 only by about half a billion dollars. The House Appropriations Subcommittee did make a rather drastic cut in the request for Air Force appropriations, but much of this was ultimately restored.[23] In the area of scientific research, as in authorized troop strength, the Army continued to receive the least support. The total FY-1948 funds allowed for missile research and development in the three services amounted to $86.8 million, a gain of $23.9 million over the preceding year. The Army's share of this gain amounted to $1.5 million, its R&D budget for the year amounting to $13.8 million (about 16 percent of the total R&D budget).[24]

(U) If the Air Force failed to get its 70-group program, it did at least establish for itself a commanding position as against the Navy and the Army. In fact, the 1948 budget had the effect of launching the independent Air Force on its career as the dominant element in American military policy. Air Force strategy was not devised as an economy measure, but partly because it seemed economical, the Air Force henceforth would come first with Congress. Increasingly, the military policy of the nation was to revolve around "the dreadful, and in most situations inapplicable, Air Force concept of 'strategic' bombing with mass-destruction weapons."[25] It was an expensive program, when considering that the cost of one all-jet B-52 bomber was $8 million, as compared to only $600,000 for a B-29 in 1945. Billions of dollars ultimately went into the construction of bases outside the country where elaborate radar

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[22] Millis, Arms and the State, p. 200.

[23] Ibid., p. 200.

[24] R. J. Snodgrass, "Ordnance Guided Missile Program, 1944 - 1954," Hist Br, OCO, p. 77. Draft of MS in Hist Div Files.

[25] Millis, Arms and the State, p. 200.

installations would warn of an enemy attack and the U. S. interceptor aircraft would serve as the first line of defense.[26]

(U) For the crises which lay immediately ahead, air-nuclear power was to prove a nearly useless military instrument. Be that as it may, the FY-1948 budget, representing a collaboration between the Democratic officials of the Truman Budget Bureau and the Republican representatives in the congressional committees, set the basic pattern of American military policy which was to rule, substantially, down to June 1950.[27]

(U) The Crisis of 1950

(U) In the wake of mounting world tension during 1948-49, the inadequate size of our conventional forces had steadily received more notice; but President Truman still insisted that defense spending remain within the $15 billion ceiling. The defense budget for FY 1950 was no exception; in fact, it imposed even more restrictive limits on military spending, the bulk of the funds still being poured into aircraft procurement. Ironically, just 6 days before the end of that fiscal year, eruption of the Korean crisis destroyed this entire budgetary, fiscal, and strategic approach to the problems of military preparedness.[28] As one noted military analyst said:

> . . . The fault lay not so much in neglect of military preparations as in a one-weapon defense policy. . . . The American public backed this . . . policy by accepting the heaviest tax burden in the country's history. Defeat and disaster were the price paid in Korea by troops who had never been trained for a limited war against Far Eastern adversaries.[29]

(U) When the United States entered the Korean fight, in early July 1950, its military strength in the Far East consisted solely of four infantry divisions and one Regimental Combat Team, none of which was fully prepared for battle. They lacked a third of their organic

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[26] Lynn Montross, War Through the Ages (New York, 1960), p. 975.

[27] Millis, op. cit., p. 201.

[28] Ibid., pp. 217 - 19.

[29] Montross, War Through the Ages, pp. 974 - 75.

infantry and artillery units and almost all of their armor; their existing units averaged 70 percent of full strength; and their ammunition reserves amounted to a 45-day supply. These forces were flown to Korea with outmoded weapons and pitted against the superior North Korean force of 10 divisions. Most of their heavy guns had been "mothballed"; their largest artillery pieces, the 105-mm. howitzers, were outranged by the enemy's 155-mm. howitzers. Their M-24 tanks could not cope with the heavier Russian T-34's; their 2.36-inch rocket launchers were woefully ineffective against the steel hides of the enemy tanks.[30]

(U) Compelled by their general unreadiness to disregard the principle of mass, American forces entered Korea in a piecemeal fashion to trade space for time. If the development program recommended by the Stilwell Board in May 1946 had been properly financed, there can be little doubt that this costly situation would have been reversed and many lives saved. But the shortage of funds, particularly in the Army, simply prevented an adequate level of research effort. As a result, the weapons which could have completely transformed the fighting in Korea were yet on the drawing board or, at best, in the early stages of development.

(U) From 1944 through FY 1949, the funds apportioned to missile research and development projects in all three services amounted to $292.6 million, and the Army's share of these funds was less than 20 percent ($56.5 million).[31] At the end of December 1949, the Army's major rocket development projects embraced four surface-to-surface artillery rockets with conventional warheads[32] and a 76-mm. antiaircraft

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[30](1) Ibid., p. 974. (2) ROTCM 145-20, pp. 495, 497 - 98.

[31]Snodgrass, op. cit., p. 77. Following are actual R&D obligations in millions of dollars, with the Army's share shown in parenthesis: FY 1946 & Prior Years, 70.9 (14.5); FY 1947, 62.9 (12.3); FY 1948, 83.7 (13.8); FY 1949, 75.1 (15.9).

[32]These included the T137 Area Saturation Weapon; the 6.5-inch, T133 Artillery Rocket; the 2.75-inch, T131 Rocket; and the 3.5-inch, T205E1 Bazooka-Type Antitank Rocket, the latter being developed to replace the 2.36-inch Rocket then in use.

rocket known as the Loki. All of these weapons were yet in the early development stage and three of them—including the Loki—would never see completion.[33] The larger, more complex, and more expensive guided missile systems were in much the same boat. Because of limited R&D funds, the development time scales had already been lengthened by 2 years as early as January 1950.[34]

(U) Beginning with the Korean emergency, R&D funds were much easier to get, but the Army's share of the total budget remained essentially unchanged. The total R&D appropriations increased from $75.1 million in FY 1949 to $105.6 million in 1950 and to $178.5 million in 1951. The Army's share of the latter two budgets was $22.8 million and $55.4 million, respectively. Funds appropriated for missile procurement in 1950 and 1951 followed much the same pattern. The total missile procurement funds amounted to $23.7 million in 1950, and increased to $208.6 million in 1951, the Army's share amounting to $2.4 million and $23 million, respectively.[35]

(U) With the budgetary supplement made available in the fall of 1950 and after, some of the Army's rocket and guided missile projects—such as the improved antitank rocket, the Corporal Surface-to-Surface Guided Missile, and the Nike Ajax Antiaircraft Guided Missile—were put on a crash basis to expedite development, production, and delivery to the field. In addition, some new weapon systems were rushed into development to remedy critical deficiencies in certain equipment of the Army Ground Forces.

(U) Unfortunately, the undivided attention and high priority finally accorded the development of modern ground combat equipment came too late to be of any immediate comfort to the troops in Korea.

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[33] (1) Mary T. Cagle, "Design, Development & Production of Rockets and Rocket Launchers," (RSA, 1 Jul 54) pp. 1, 12, 16, 23, 74. (2) Also see Mary T. Cagle, "LOKI Antiaircraft Free-Flight Rocket System, December 1947 - November 1955," (RSA, 17 Apr 57). Both in Hist Div Files.

[34] Snodgrass, op. cit., p. 34.

[35] Ibid., p. 77.

Because of the long lead time involved in the production of major military items, the equipping of combat units proceeded at a painfully slow pace. The products of the partial mobilization begun in 1950 were not available in any significant volume until the middle of 1952—and the war ended a year later.[36]

(U) The Honest John Field Artillery Rocket was one of the new weapons born in the backlash of the Korean emergency, but it did not reach the field until 6 months after the war ended. It is the origin of the Honest John project to which this study now turns.

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[36]ROTCM 145-20, p. 520.

CHAPTER II

(U) ORIGIN OF THE HONEST JOHN DEVELOPMENT PROGRAM (U)

(U) The decision to accelerate Army research and development programs in late 1950 represented the culmination of a frustrating period in which rocket research had been turned on, off, and on again, depending upon the extent of budget cuts necessary to stay within the annual defense ceiling. During these lean years, the Ordnance Corps had concentrated its initial effort on basic research in the field of solid propellants and then built production models of field artillery weapons beginning with the smallest caliber rockets because these involved a lower outlay of funds.

(U) In 1946 it had appeared that a large-caliber rocket capable of supplementing conventional artillery in the field of super-heavy weapons might be developed within the predictable future, the main problem being the achievement of improved accuracy and flexibility over that of existing artillery guns. Despite rapid advancements in rocket technology, the tactical requirement for this special-purpose field artillery rocket was yet unfilled 4 years later, partly because of budgetary restrictions and partly because of persisting doubt that the desired accuracy could be achieved with such a large, unguided rocket.[1]

(U) Revision of the Army Equipment Guide (U)

(U) In the wake of rapid changes in the world political and military situation, the unfulfilled requirements for key items of Army equipment became a matter of mounting national concern. During the early months of 1950, the Army Chief of Staff commissioned a board of officers—known as the Army Equipment Board and headed by Lieutenant General John R. Hodge—to conduct a critical review of the Army's

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[1] See above, pp. 5 - 6, 13 - 14.

current equipment requirements and to draw up a revised research and development guide.[2]

(U) In determining the scope of these requirements, the board had to consider the obvious limits of money and other resources that could be directed to the improvement of existing Army equipment and to the continuation of basic research. Another important governing factor was the time element. While projecting the overall requirements far ahead, there was "the urgency for a high degree of concentration on those items from which the greatest benefit can reasonably be expected in the foreseeable future."[3] Of prime concern, then, were the qualitative, unfulfilled requirements for principal items of equipment and supplies needed to supplant outmoded models currently in use. The first responsibility was "to win a war that may come at any time."[4]

(U) Whereas the Stilwell Board had given top national defense priority to the development of more potent atomic bombs and strategic aircraft, the Hodge Board now gave first priority to the development of modern equipment urgently needed to place the Army's ground forces back on an effective combat footing. The board concluded that the existing "critical deficiencies" in certain Army weapons and equipment constituted a "national danger" and "must be remedied without delay . . . ."[5] It therefore recommended that the highest priority and greatest support be given to the development and procurement of antitank weapons, tanks and tank ammunition, antiaircraft and antimissile missiles, atomic

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[2]"Army Equipment Development Guide," 29 Dec 50, pp. ii, iii. RSIC. This document, consisting essentially of the Army Equipment (Hodge) Board Report, superseded the Stilwell Board Report of 29 May 1946. Members of the board included Major Generals Roscoe B. Woodruff, George D. Shea, John H. Collier, Rupert E. Starr, Wayne C. Zimmerman, and Raymond E. S. Williamson.

[3]Ibid., p. 3.

[4]Ibid. By the time the Hodge Board Report had filtered down through review channels to final approval and publication on 29 December 1950, that war had already become a reality and was in fact 6 months old.

[5]Ibid., p. 10.

weapons and suitable means for delivery, and other items of supporting equipment.[6] The board further specified that "Emphasis must be directed toward development of atomic weapons suitable for all weather employment by ground forces against enemy field forces and their supporting installations utilizing guided missiles, rockets, and gun type weapons."[7]

(U) The Ordnance Corps promptly acted to meet part of this requirement with a special-purpose, large-caliber rocket—later to be known as the Honest John—and actually began design studies of such a weapon in May 1950 while the board discussions were yet in the preliminary stages. By the time the new Army Equipment Guide reached publication in December 1950, the initial design studies had been completed and work on the fabrication of five feasibility demonstration models had been under way for 2 months. In the light of persisting skepticism as to the potential value of such a weapon, there can be little doubt that the expeditious handling of the initial feasibility studies materially assisted the Chief of Ordnance in obtaining favorable consideration for the project.[8]

(U) Preliminary Design Studies (U)

(U) The groundwork leading to the establishment of the formal development program, in August 1951, actually consisted of two interrelated programs, the end objective of which was to demonstrate the feasibility of developing a free-flight artillery rocket as a direct-support atomic-weapon carrier. It began with a series of preliminary

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[6] Ibid., p. 10.

[7] Ibid., p. 8. (Note above the contrasting conclusions of the Stilwell Board, p. 4.)

[8] (1) Ltr, 00 471.94/280, CofOrd to CO, RSA, 25 May 50, sub: Problem Asgmt No. 12, Proj TU2-7C, DA Pri 1C. ORDTU File, Problem XII - 15,000 Yard Special Purpose Rocket, May 50 - Sep 50, Military Records Branch, General Services Administration, Federal Records Center, Alexandria, Va. (ORDTU files on Honest John Projects TU2-7C and TU2-1029 are hereafter cited as follows: ORDTU File, [period covered], MRB GSA FRC.) (2) Technical Report, Ordnance Guided Missile & Rocket Programs, Vol V, Honest John, Inception thru 30 Jun 55, pp. 1, 3. This document is hereafter identified as: HJ Blue Book.

design studies and ended with the flight test of five prototype models in mid-1951.

(U) In April 1950, Dr. J. B. Edson of the Research Branch in the R&D Division of the Office, Chief of Ordnance (OCO), suggested that an investigation be conducted to determine the feasibility of delivering atomic warheads by free-flight rockets. A cursory study of the problem, made by the Rocket Branch of that Division, indicated that a free-flight rocket could be developed that would essentially meet the requirement for a range of 15,000 yards and a payload of 1,500 pounds.[9] Accordingly, the Ordnance Technical Committee, in early May 1950, approved the initiation of design studies to determine the characteristics of such a rocket.[10]

(U) Late in May 1950, the Chief of Ordnance directed the Redstone Arsenal to make a preliminary design study of a special-purpose rocket capable of carrying a 1,500-pound payload to a range of 15,000 yards or more with a circular probable error of 300 yards or less at maximum range. Since this was an entirely new type of weapon, precise military characteristics were not established. Hence, the initial design study was chiefly concerned with determining the theoretical potentialities of the free rocket as an atomic delivery system. The immediate objective was to obtain a quick visualization sketch and design of a suitable tube or rail-type launcher on a self-propelled vehicle and a fin-stabilized rocket using a modification of an existing jet-assisted-take-off (JATO) unit. Tentative specifications for the warhead called for an overall length of about 75 inches, with an inside diameter at the base of not less than 15 inches.[11]

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[9] "History of HONEST JOHN," 23 Aug 51, Rkt Br, R&D Div. ORDTU File, Jun - Aug 51, MRE GSA FRC.

[10] OCM 33836, 3 May 50, cited in HJ Blue Book, pp. 1, 50.

[11] (1) Ltr, 00 471.94/280, CofOrd to CO, RSA, 25 May 50, sub: Problem Asgmt No. 12, Proj TU2-7C, DA Pri 1C; & Incl 1 thereto, "Problem Assignment," 24 May 50. ORDTU File, May - Sep 50, MRB GSA FRC. (2) HJ Blue Book, pp. 1 - 2.

(U) In their search for a suitable off-the-shelf motor, the design engineers of Redstone's Ordnance Rocket Center found that the Navy-developed 3-DS-47,000, X201A1 JATO unit came closest to imparting the required impulse. From the design studies and calculations, they concluded that a fin-stabilized free rocket, propelled by the X201A1 JATO unit, could be built to deliver a 1,500-pound payload to ranges in excess of 15,000 yards. With a slight decrease in drag or payload, or with a slight increase in rocket impulse, it appeared that ranges up to 20,000 yards might be obtained. The proposed launchers were of two general rail types: one mounted on a self-propelled vehicle and the other a knock-down type adaptable to air transport.[12]

(U) Upon receipt of the initial study results, the Chief of Ordnance directed that the work under Problem 12 be extended to include consideration of a longer range, fin-stabilized rocket using the Navy-developed 4-DS-105,000, X202C1[13] JATO unit. Aside from sketches of the proposed missile design, the study report was to include theoretical calculations on missile range, probable error in range and deflection, and time of flight.[14] The R&D Division, OCO, requested the necessary funds ($60,000) for this additional study, in mid-August 1950; however, the Assistant Chief of Staff (ACofS), G-4, held up final approval for more than a month, and the allotment was not made available to the Redstone Arsenal until late September.[15]

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[12](1) RSA Report A-7-a, 1 Jul 50, sub: Interim Progress Report, 15,000 Yard Special Purpose Rocket, Phase I, Problem 12, Project TU2-7C. (2) RSA Report A-7-b, sub: same, 11 Aug 50. Both in RSIC.

[13]The code designation denotes the burning time, in seconds, the type propellant, the nominal thrust, in pounds, and the experimental model number. For example, the eXperimental 202C1 model—later procured from the Navy for use with the interim Honest John system—had a 4-second burning time, used OV Cast Double Base Solid Propellant, and produced a nominal thrust of 105,000 pounds.

[14]Ltr, OO 471.94/457, CofOrd to CO, RSA, 11 Aug 50, sub: Problem No. 12, Proj TU2-7C. HJ R&D Case Files, Box 14-9, Records Holding Area, Army Missile Support Command (RHA AMSC).

[15]Ltr, OO 121.2/1809, CofOrd to CO, RSA, 21 Sep 50, sub: RAD Order No. ORDTU-1-12475, Proj No. TU2-7C, Problem 12, DA Pri 1B; & Incl 1 thereto, sub RAD Order, 14 Aug 50. ORDTU File, May - Sep 50, MRB GSA FRC.

(U) The results of this supplementary study, published in November 1950, indicated that a fin-stabilized free rocket, using the higher-thrust X202C1 JATO unit, could be built to deliver a 1,700-pound payload to ranges in excess of 20,000 yards. Here again, the design engineers used conservative drag estimates, and it appeared that ranges up to 25,000 yards might be obtained with slightly less drag or with slightly higher rocket impulse. In calculating the approximate performance characteristics of the rocket, they used a mean temperature of 77°F., the safe temperature limits of the OV cast double base propellant having been certified as 40°F. to 100°F.[16]

(U) Though treated as an off-the-shelf item for purposes of the design study, the X202C1 booster motor had not been fully developed and was yet to be proved in actual flight tests.[17] Its physical and ballistic properties, however, had been established in static tests and published during 1949 in the M1 JATO Manual of the Solid Propellant Information Agency. The temperature restrictions specified for the OV-type solid propellant constituted a distinct disadvantage, in that the JATO unit could be fired only after storage at a constant temperature between 40° and 100°F. for 48 hours. The unit could be exposed to temperatures as low as 0°F. or as high as 130°F. for a period not exceeding one hour before use; but if the exposure should exceed one hour, it would have to be returned to a storage chamber within the above temperature range for another 12-hour period before firing. Recognizing that these temperature restrictions would render the rocket unsatisfactory for service use, the design engineers pointed out that a motor

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[16] RSA Report A-7-c, "Interim Progress Report, Special Purpose Rocket, Phase I, Problem 12, Project TU2-7C," 1 Nov 50. RSIC.

[17] Intvw, Mary T. Cagle with Casper J. Koeper, 14 Mar 63. (Mr. Koeper assisted in the Phase I design studies and prepared the final study reports (A-7-a, b, and c) in his capacity as head of the Engineering Section Ordnance Rocket Center. He is currently assigned to the Army Missile Command as chief of the Technical Staff, Ground Support Equipment Laboratory, Directorate of R&D.)

incorporating a propellant with much broader temperature limits would be designed in the planned Phase II study.[18]

(U) The twofold objective of the Phase II study, originally assigned under Problem 12, was to provide a more detailed design analysis and to select a rocket having the most promising type of fin or spin stabilization and a minimum of dispersion.[19] However, the Chief of Ordnance decided, in late November 1950, that sufficient work had been done to establish the preliminary rocket design and that further work on Problem 12 should be discontinued.[20]

(U) Phase II Design and Feasibility Study (U)

(U) Meanwhile, in late August 1950, the ACofS, G-4, had directed the Chief of Ordnance to proceed with a limited firing program to investigate the performance characteristics of a large-caliber, free-flight rocket which would be capable of delivering an atomic warhead.[21] Broadly, the problem was to provide an atomic weapon capability for the ground forces, using more efficient nuclear systems than contemplated in other developments for similar uses. Since this represented the first attempt to provide such a weapon, the accuracy, range, and other performance characteristics would be determined through demonstration firings before proceeding with full-scale development. The rocket was to have a maximum range of 20,000 yards and carry a 1,500-pound payload.[22]

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[18] RSA Report A-7-b, 11 Aug 50, sub: Interim Prog Rept, 15,000-Yard Sp Purpose Rkt, Ph I, Problem 12, Proj TU2-7C. RSIC.

[19] Incl 1 to Ltr, OO 471.94/280, CofOrd to CO, RSA, 25 May 50, sub: Problem Asgmt No. 12, Proj TU2-7C, DA Pri 1C. ORDTU File, May - Sep 50, MRB GSA FRC.

[20] Memo to File, John W. Womble, HJ Proj Engr, to Chf, Ord Rkt Cen, 4 Dec 50, sub: Sp Purpose Rkt Proj [Notes on Conf at OCO, 29 Nov 50]. HJ R&D Case Files, Box 14-9, RHA AMSC.

[21] DF, G4/F4-42667, to CofOrd, 12 Jul 51, sub: Rkt Delivery of Atomic Whds. ORDTU File, Jun - Aug 51, MRB GSA FRC.

[22] "Historical Sketch - HONEST JOHN Rocket," 8 Jul 52. ORDTU File, Jul - Aug 52, MRB GSA FRC.

(U) Organization of the Program (U)

(U) Apparently having received advance notice of this requirement, the Chief of Ordnance had extended the Phase I design study to include such a capability some 10 days earlier, on 11 August.[23] In early September 1950, Colonel Holger N. Toftoy, then head of the Rocket Branch, R&D Division, OCO, drew up a development plan to meet the extended range requirement, and asked the Los Angeles Ordnance District to obtain a firm quotation from the Douglas Aircraft Company for performance of the required work. In a letter to the district chief, on 8 September, he noted that preliminary discussions had been held with representatives of Douglas Aircraft[24] and that their organization would be able to conduct the necessary development work in the time required. He also noted that the Douglas Aircraft Company had been selected for these discussions because of its familiarity with the JATO units which were to be used.[25]

(U) The scope of work outlined for consideration in the contractor's cost proposal embraced a two-part program consisting of 25 missiles, complete with warhead. Phase I of the program called for the design, fabrication, and flight test of 15 missiles (Model 1236E) to be composed of a 1,000-pound warhead assembled to the 3-DS-47,000, X201A3 JATO unit. Phase II called for 10 missiles (Model 1236F) having a warhead weight of 1,600 pounds and using the 4-DS-105,000, X202C1 JATO unit. The tentative target date for completion of Phase I flight tests was March 1951; the schedule for Phase II firings would depend upon the

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[23] See above, p. 21.

[24] As a result of these early discussions, the Douglas Aircraft Company (DAC) of Santa Monica, California, had submitted a proposal, in July 1950, for four alternate versions of the special-purpose rocket, designated as "Contractor Model 1236," the respective versions being identified by code letters A through D. Ltr, DAC to Chf, Rkt Br, Ord R&D Div, 12 Jul 50, sub: Proposal for Model 1236 Ground-to-Ground Msl. ORDTU File, Jul 50 - May 51, MRB GSA FRC.

[25] Ltr, 00 491.94/555, CofOrd to Dist Chf, LAOD, 8 Sep 50, sub: Dev of Large Cal Sp Purpose Free Rkts. ORDTU File, Jul 50 - May 51, MRB GSA FRC.

availability of JATO units which were to be furnished by the Government.[26]

(U) Meanwhile, serious funding problems had been developing which eventually caused a drastic reduction in the scope of program plans. To finance the program directed by the General Staff, the Chief of Ordnance had asked for $1,100,000 in the supplemental budget for Fiscal Year 1951. This amount was originally intended to support complete development of the lightweight (1236E) model on a first priority basis, the level of effort on the heavy (1236F) model being limited to a design study and some experimentation. However, the supplemental budget request was not adopted with a sufficiently high priority to reach Congress, and the General Staff returned the action for resubmission.

(U) The new budget request, submitted on 5 September 1950, amounted to $2,100,000, the increase resulting from desires expressed by both the General Staff and the Committee on Atomic Energy of the R&D Board that development of the heavy (1236F) model also proceed at maximum speed to a finally accepted prototype. Realizing that these funds, if approved, would not be available until the third quarter of the fiscal year, the Committee on Atomic Energy indicated that $500,000 of its funds would be recommended for transfer to this program. Dr. J.R. Oppenheimer, as special consultant, criticized this as being insufficient and recommended $2 million as a minimum. But this much money apparently was not available to the board; and, in fact, the Ordnance Corps had no assurance that it would even get the lesser amount. The Chief of the Research Branch, OCO, put it: "We cannot count on any of the amounts mentioned . . . . There is more danger of omission than of duplication."[27]

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[26](1) Ibid. (2) Ltr, DAC to Chf, Rkt Br, R&D Div, OCO, 7 Sep 50, sub: Proposal for Models 1236E and 1236F. ORDTU File, Jul 50 - May 51, MRB GSA FRC. (The proposal in this letter was a revised version of the one submitted in July 1950 [see footnote 24 above]. It was based on agreements reached in further discussions between Ordnance Corps and Douglas Aircraft representatives.)

[27]Memo, Chf, ORDTB-AE, to Chf, ORDTX, 5 Sep 50, sub: Rkt & Lchr, Special. ORDTU File, Jul 50 - May 51, MRB GSA FRC.

(U) Upon receipt of the $500,000, in late September 1950, the Chief of Ordnance established Project TU2-1007D, "Large Caliber Field Rocket, Department of the Army Priority 1A." The order transferring these funds to the Los Angeles Ordnance District specified a delivery date of 31 March 1951 (as originally established for Phase I effort), and stated that the research work would be conducted under the technical supervision of the Office, Chief of Ordnance.[28] With a reduction in the quantity of Model 1236E missiles from 15 to 14, and certain other minor adjustments, the Douglas Aircraft Company quoted a revised estimated cost of $499,956 for the Phase I effort, and $551,640 for the 10 Model 1236F missiles under Phase II, the total estimate of $1,051,596 including a fixed-fee of $68,796.[29] The Chief of Ordnance accepted these proposals and used them as a basis for initial contract negotiations; however, for reasons which will become obvious presently, the Phase I (Model 1236E) program was later scrapped and the effort under Phase II was drastically curtailed.

(U) Since the nature of the proposed rocket development work precluded the drafting of precise specifications, it was essential that such work be performed by competent scientific personnel highly skilled in rocket and JATO design and in the use of specialized equipment and techniques. Having determined that procurement of the necessary services and supplies by competitive bid would not be feasible in this case, the Under Secretary of the Army authorized negotiation with a single-source contractor.[30]

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[28] RAD Order ORDTU-1-12669, OCO to Dist Chf, LAOD, 27 Sep 50. ORDTU File, Jul 50 - May 51, MRB GSA FRC.

[29] Ltr, DAC to LAOD, 12 Sep 50, sub: Proposal for Models 1236E and 1236F Ground-to-Ground Msls, attached as Incl to Ltr, Dist Chf, LAOD, to CofOrd, 15 Sep 50, sub: Dev of Large Cal Sp Purpose Free Rkts. ORDTU File, Jul 50 - May 51, MRB GSA FRC.

[30] Pursuant to Section 2(c)(11) of the Armed Services Procurement Act and paragraph 3-211 of the Armed Services Procurement Regulation. Determination and Findings (D&F) ORD-332, Proj TU2-1007D, 13 Oct 50. ORDTU File, Jul 50 - May 51, MRB GSA FRC.

(U) The Chief of Ordnance selected the Douglas Aircraft Company as the single-source contractor for the early research and experimental work because of its established reputation and past experience in closely related scientific fields. Douglas Aircraft had been—and still was—engaged in R&D work for the Ordnance Corps, participating in the development of such complex missile systems as the Hermes, the Corporal, and the Nike Ajax—the latter system using the same type JATO unit as that proposed for the large-caliber field rocket. Another governing factor was the current conflict in the Far East and the consequent need to complete development of an interim emergency weapon as soon as possible. It was the considered judgment of Ordnance officials that the wealth of experience and facilities available in Douglas Aircraft would expedite the program and assure timely completion of a field-worthy weapon at reasonable cost.[31]

(U) In mid-October 1950, the General Staff approved the Phase I proposal and authorized the award of a 90-day letter order contract for $250,000, pending final approval of a formal contract.[32] A few days later, the Chief of Ordnance decided to drop the Phase I (Model 1236E) program in favor of the Phase II, Model 1236F, because the X202C1 JATO unit was the only one that could be made available in a reasonable length of time. In view of this shift in plans and the limited funds then available, he instructed the Los Angeles Ordnance District to issue a letter order in the amount of $250,000 for prompt start of work, and to begin negotiation of a formal contract for five rather than 10 Model 1236F missiles, the total cost not to exceed $500,000. Although 15 rounds had been established as the minimum number necessary to obtain statistically conclusive results, funding restrictions limited the

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[31] HJ Blue Book, p. 2.

[32] Cmt 2, ACofS, G-4, to CofOrd, 13 Oct 50, on DF, CofOrd to G-4, 2 Oct 50, sub: Request to Execute LO with DAC. ORDTU File, Jul 50 - May 51, MRB GSA FRC.

initial procurement to five units and plans for additional procurement remained indefinite for the better part of the next 6 months.[33]

(U) The Douglas Aircraft Company signed the letter order contract for $250,000, on 26 October 1950, and immediately began preliminary laboratory studies.[34] To keep the total dollar value of the formal contract within the specified limit of $500,000, the Ordnance District was forced to reduce the scope of certain laboratory work to a bare minimum. With this reduction, the contractor proposed a total estimated cost of $465,026.19, plus a 6.66 percent fee of $31,000, making a total contract value of $496,026.19.[35] The Under Secretary of the Army approved the award of a formal contract in this amount, early in January 1951. Supplemental Agreement 1 to the basic letter order contract was signed by Douglas Aircraft on 26 January.[36]

(U) As envisioned by Redstone's engineering staff, the ultimate weapon was to be a simple, cheap, highly mobile, and reliable free-flight rocket. It was to have no complicated electronic equipment, and therefore would not require highly skilled operators or maintenance technicians. Here, perhaps, was the main source of lingering opposition to the project. How could such a large, unguided rocket possibly have the required accuracy? This was the time-honored question posed by skeptics in the Pentagon. And it was precisely this question which the Redstone-Douglas team sought to answer in the Phase II program.

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[33](1) TT ORD-10605, CofOrd to LAOD, 20 Oct 50. (2) Ltr, CofOrd to LAOD, 20 Oct 50, sub: Issuance of LO for Large Cal Fld Rkt, Proj TU2-1007D, DA Pri 1A. (3) Proj Outline, "Mobile Rocket and Launcher Project TU2-1007D, DOA 5-17-07-007," 9 Nov 50. All in ORDTU File, Jul 50 - May 51, MRB GSA FRC.

[34]TT, LAOD to CofOrd, 1 Nov 50 [re Contr DA-04-495-ORD-22]. ORDTU File, Jul 50 - May 51, MRB GSA FRC.

[35](1) TT ORD-11873, CofOrd to LAOD, 20 Nov 50. (2) Ltr, LAOD, thru CofOrd, to ACofS, G-4, 15 Dec 50, sub: Request for Appr of Awd - DAC. Both in ORDTU File, Jul 50 - May 51, MRB GSA FRC.

[36](1) 2d Ind, G4/E1-330, ACofS, G-4, to CofOrd, 4 Jan 51, on Ltr cited in foregoing footnote 35(2), file same. (2) HJ Blue Book, p. 7.

(U) Evolution of the Honest John Prototype (U)

(U) The primary objective of the Phase II program, which thus commenced in the fall of 1950, was to provide definite proof of weapon system feasibility through the design, development, fabrication, and test of actual components as an assembled unit. The program schedule called for the manufacture of five Model 1236F rockets, which were to be delivered at the rate of one per week beginning on 22 June 1951.[37] The completed rockets were to be capable of delivering a 1,500-pound warhead to a minimum range of 20,000 yards, with dispersion not to exceed 10 mils, or 200 yards' lateral deflection, and a range probable error of 300 yards or less. Specifications for the rocket design configuration—largely dictated by the characteristics of the X202C1 motor—were as follows:[38]

Maximum Length.....	327.5 inches
Nose Diameter.....	31.0 inches
Body Diameter.....	23.0 inches
Wing Span.....	104.0 inches
Nose Length (ogive).....	82.0 inches
Weight, Loaded.....	5,800.0 pounds
Weight, Empty.....	3,780.0 pounds

(U) Preliminary studies of the dispersion problem, conducted in October and November 1950, revealed that a free rocket could be used for the propulsion unit of the weapon, but some method would be required to correct for the thrust malalignment, tip-off, cross-wind, and other effects present during acceleration. The R&D contractor proposed two basic designs which appeared to give dispersions within the desired limits and which would be simple and fairly inexpensive to construct. One of the proposed designs, designated as Model 1236F, was that of a

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[37](1) Ibid., pp. 3, 7. (2) Ltr, LAOD, thru CofOrd, to ACofS, G-4, 15 Dec 50, sub: Request for Appr of Awd - DAC. ORDTU File, Jul 50 - May 51, MRB GSA FRC. (3) It should be noted that the formal contract amount ($496,026.19) did not cover field test operations; funds for this part of the program were not provided until mid-May 1951—the month before flight tests actually began.

[38]HJ Blue Book, p. 3.

free rocket guided only by the launcher rail and using eight auxiliary rockets for initial spin stabilization and canted fins for in-flight stabilization. The other design was a semicontrolled version of the same basic rocket, known as Model 1236G, which used a simple autopilot system (instead of spin rockets) for aerodynamic control during the burning phase only, the rocket thereafter following a free ballistic trajectory.[39]

(U) The Chief of Ordnance decided, in December 1950, that the first five test rockets would be the simpler, unguided model (1236F); however, he instructed the contractor to continue design studies on an autopilot system for later use in semicontrolled (1236G) units. At the same time, he announced that the Redstone Arsenal would have responsibility for technical supervision of the project, including the coordination of activities for all concerned agencies and contractors.[40] The transfer of this responsibility from the Office, Chief of Ordnance,[41] to the Commanding Officer of Redstone Arsenal was later confirmed in an official communication.[42] Nevertheless, elements of the R&D Division, OCO, continued to deal directly with the various agencies and contractors, often without consulting or advising responsible officials of the Redstone Arsenal. As a result, some aspects of the program—particularly those relating to major items of Government-furnished equipment—soon began to suffer from a lack of coordination, and the prevailing

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[39] (1) Ibid., pp. 4, 7. (2) OCM 33836, rev 11 Jul 51, approved 2 Aug 51. RSIC.

[40] Memo to File, John W. Womble, HJ Proj Engr, 19 Dec 50, sub: Ord Proj TU2-1007D, Trip Rept - Visit to WSPG and DAC, 11 - 14 Dec 50. HJ R&D Case Files, Box 14-9, RHA AMSC.

[41] See above, p. 26.

[42] Ltr, CofOrd to Dist Chf, LAOD, 15 Jan 51, sub: Appr of Awd - DAC. ORDTU File, Jul 50 - May 51, MRB GSA FRC. (This letter stated, in part: "The technical supervision for this project has been transferred from Office, Chief of Ordnance as shown on RAD Order ORDTU 1-12669 [27 Sep 50], to Redstone Arsenal, Huntsville, Ala. . . .")

atmosphere at the lower echelon was one of general confusion and frustration.[43]

(U) Another important policy decision, made in the early fall of 1950, provided for the maximum use of available, on-the-shelf hardware as a means of reducing costs and saving time. Major rocket components which fell in this category were the main power plant and the spin rocket.

(U) As noted earlier, the power plant selected for the initial prototypes was the 4-DS-105,000, X202C1, solid propellant booster motor, which the Department of the Navy was developing for its TALOS ship-to-air guided missile system.[44] In October 1950, the Ordnance R&D Division ordered 15 X202C1 JATO units from the Department of the Navy for use in static firings and initial R&D flight tests.[45] The metal parts for these motors were "tailor made" with close tolerances by the M. W. Kellogg Company, Jersey City, New Jersey. They were loaded by the

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[43](1) Memo, Lt Col W. J. Durrenberger, Dir of Projs, RSA, to Chf, Tech & Engr Div, RSA, 14 Jan 52, sub: Responsibility for HJ Dev Proj. HJ R&D Case Files, Box 14-9, RHA AMSC. (2) Also see Mary T. Cagle, "History of the Lacrosse Guided Missile System, 1947 - 1962," (AMICOM, 10 Sep 62) pp. 27 ff.

[44](1) "HONEST JOHN Historical Summary, Feasibility Study thru 30 Sep 58, and Missile System Monthly Progress Report, 1 Oct thru 31 Oct 58," Army Rocket & Guided Missile Agency (ARGMA), p. 8. (This document hereafter cited as: HJ Hist Sum, FS thru 31 Oct 58.) (2) The supersonic TALOS missile evolved from the Bumblebee program which the Navy's Bureau of Ordnance started in 1945. The Applied Physics Laboratory of Johns Hopkins University conducted the initial research and development work; the Allegany Ballistics Laboratory and Hercules Powder Company produced the booster motor and propellant. Frederick I. Ordway, III, and Ronald C. Wakeford, International Missile and Spacecraft Guide (New York, Toronto, & London, 1960), p. USA/25.

[45](1) DF, 00 471.94/977, CofOrd to Chf, BuOrd, DN, 11 Dec 50, sub: Proc of JATO's 4-DS-105,000 [Reqn ORD-51-AB-1065, 19 Oct 50]. (2) The initial requisition was later increased to include five spares, making a total of 20 motors at a cost of $400,000 ($20,000 each). Ltr, CofOrd to DAC, 10 Apr 51, no sub. Both documents in ORDTU File, Jul 50 - May 51, MRB GSA FRC.

Allegany Ballistics Laboratory,[46] then shipped to the White Sands Proving Ground for final assembly and flight test.[47]

(U) Like the main power plant, the spin rocket selected was an off-the-shelf item which had been developed by the Jet Propulsion Laboratory[48] for use on an early research vehicle known as the Bumper WAC (Without Altitude Control). The Douglas Aircraft Company provided the metal parts for 16 spin rockets (2 sets), which were loaded by the Redstone Division of the Thiokol Corporation and spin tested for manifold performance at the Jet Propulsion Laboratory. Based on the results of these two laboratory tests, 40 additional spin rockets (5 sets) were rushed to completion for use in the five demonstration firings.[49] Many of the technical difficulties later experienced in the flight test program stemmed

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[46]The Allegany Ballistics Laboratory (ABL), an old name in double-base solid propellant rocket research, development, and manufacture, is located at Cumberland, Maryland. During World War II, it was operated by the George Washington University under contract with the National Defense Research Committee of the Office of Scientific Research and Development. After the war, the ABL was absorbed by the Naval Bureau of Ordnance and continued to develop propulsion systems for all of the technical services. Andrew G. Haley, Rocketry and Space Exploration (Princeton, N. J., 1959), pp. 69, 93, 165.

[47](1) MFR, J. W. Womble, HJ Proj Engr, to Chf, ORC, 4 Dec 50, sub: Sp Purpose Rkt Proj [Notes on Conf at OCO, 29 Nov 50]. (2) MFR, J. W. Womble, 19 Dec 50, sub: Ord Proj TU2-1007D, Trip Rept - Visit to WSPG & DAC, 11 - 14 Dec 50. Both in HJ R&D Case Files, Box 14-9, RHA AMSC.

[48]The Jet Propulsion Laboratory (JPL) was originally formed in July 1940 as a part of the Guggenheim Aeronautical Laboratory of the California Institute of Technology (GALCIT), with the mission of developing high-thrust JATO units for heavy bombers. The Army Service Forces and Ordnance Department initiated a rocket research program at the CIT in 1944. The rocket research group was then reorganized as the Jet Propulsion Laboratory and was governed by the Executive Board of the CIT. Further growth of the rocket research program took place under the Army, and liaison was expanded to include the Signal Corps, the Army Ground Forces, and the Naval Bureau of Ordnance. During the post-war years, the JPL continued to be a major factor in rocket design and development, particularly in the Jupiter missile series. Haley, Rocketry and Space Exploration, pp. 91, 98, 167.

[49]MFR, J. W. Womble, 19 Dec 50, sub: Ord Proj TU2-1007D ... Visit to WSPG & DAC, 11 - 14 Dec 50. HJ R&D Case Files, Box 14-9, RHA AMSC.

directly from the lack of time and funds for more thorough laboratory tests in this early phase of development.

(U) Limited though it was, the laboratory work completed in the last few months of 1950 had convinced Ordnance experts that the proposed large-caliber rocket was technically feasible and could be successfully developed to meet the new Army requirement for a direct-support atomic delivery system. But there were yet a few skeptics in the General Staff who argued that such a rocket could not possibly have improved accuracy over existing artillery guns, and that the Army was, in effect, "pouring money down a rat hole." At one crucial point, the Deputy Assistant Chief of Staff for Guided Missiles—obviously swayed by the mistaken judgment of his technical consultants—insisted that the entire project should be scrapped, including the few rockets being built for feasibility demonstration firings. Colonel H. N. Toftoy, who had guided the rocket program through the lean postwar years, countered this familiar argument with irrefutable scientific fact and eventually managed to save the program through an impressive rocket firing witnessed by Secretary of the Army Frank Pace and other high-ranking officials.[50]

(U) It was at the height of this controversy, in late 1950, that Colonel Toftoy conceived the idea of nicknaming the rocket "Honest John." While there are at least two other versions of how the nickname originated,[51] the available evidence supports the following version, as later told by General Toftoy.

> This rocket was developed under my responsibilities while Chief of the Rocket Branch, Research and Development Division, OCO, and the name HONEST JOHN was submitted by me for approval of higher authority. Knowing that troops usually came up with their own nicknames for weapons if they did not like the official name, we cast about for a catchy name, easy to remember. Before the test firing of the first 762mm rocket, there was considerable controversy in the Pentagon as to its worth. In

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[50] Intvw, Mary T. Cagle with H. N. Toftoy, Maj Gen, USA (retired), 18 Apr 63.

[51] See for example, Col John Redmon, "How is a Missile Named?", the Army Times, 11 Jun 60.

fact, there was serious consideration in the General Staff of cancellation on the grounds such a large unguided rocket could not possibly have the accuracy to justify further expenditure of funds. At this time, on a trip to White Sands Proving Ground, we ran into a Texan making statements hard to believe. When his veracity was questioned, he exclaimed, "Why around these parts I'm called 'Honest John'." Feeling somewhat like the Texan at the time, I felt HONEST JOHN would be an appropriate nickname.[52]

(U) The Chief of Ordnance notified the Redstone Arsenal, in December 1950, that the special-purpose rocket being developed under Project TU2-1007D had been given the name "Honest John."[53] Five months later, in May 1951, he issued an order changing the project number of the Large Caliber Field Rocket, Honest John, from TU2-1007D to TU2-1029.[54]

(U) By that time, the Douglas Aircraft Company had essentially completed its share of components for the first five 1236F prototypes and funds had been provided in the supplemental FY-1951 budget for the field test of these rockets in late June and July 1951. Also provided in the supplemental budget were funds for 10 additional 1236F units to investigate more thoroughly the performance characteristics of the unguided model, and for further expansion of the program to include the design, manufacture, and flight test of 15 units of the semicontrolled version, Model 1236G.

(U) Supplemental Agreement 3 to the Douglas contract—approved by the Director of Logistics on 17 April 1951, and signed on 15 May 1951—amounted to $1,404,346 and increased the cumulative contract cost to $1,900,372.19. Of this total, $544,943.19 covered the five-round

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[52] Ltr to Maj Gen John H. Stokes, Jr., CMH, 21 Aug 56. (At the time of this letter, General Toftoy was Commanding Officer of Redstone Arsenal. Transferring to Redstone as a colonel in May 1952, he was promoted to brigadier general on 1 November 1952 and to major general on 20 September 1956.)

[53] Post Diary Rept, Ord Rkt Cen, RSA, Dec 50. AMSC Hist Files.

[54] RAD Order ORDTU 1-13114, 25 May 51. ORDTU File, Jul 50 - May 51, MRB GSA FRC.

demonstration program presently under discussion ($496,026.19 for delivery of the five 1236F prototypes, and $48,917 for field test operations, including modification and/or fabrication of launching, handling, and test fixtures). The remaining $1,355,429 was to finance subsequent development effort; namely, the design, fabrication, and flight test of 25 additional rockets. The scope of work thus planned, approved, and placed under contract as of mid-May 1951 is shown below.[55]

	Total Est. Cost	Fixed Fee (6%)	Cost Plus Fixed Fee
Basic Contract (ORD-22)			
Deliver 5 Model 1236F.....	$ 465,026	$ 31,000	$ 496,026
Supplemental Agreement 3			
Field Test 5 Model 1236F.....	46,148	2,769	48,917
Deliver/Test 10 Model 1236F.....	235,887	14,153	250,040
Deliver/Test 15 Model 1236G.....	1,042,820	62,569	1,105,389
Total Cost: Supplement 3.....	$1,324,855	$ 79,491	$1,404,346
Cumulative Contract Cost.....	$1,789,881	$110,491	$1,900,372

(U) Added to the above contract cost were expenses incurred for certain items of Government-furnished equipment, administrative overhead, and other miscellaneous supplies and services. The cost of components and services necessary to support the expanded program amounted to $1,099,228 and increased the total 1951 funding program to $2,999,600.[56] The composition of the research and development program for Fiscal Year 1951 is shown in Table 1.

(U) Several months after approval of the above program, it became painfully apparent that some elements of the General Staff were not

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[55](1) HJ Blue Book, p. 8. (2) Ltr, Chf, LAOD, thru CO, RSA, & CofOrd, to ACofS, G-4, 16 Mar 51, sub: Req for Appr of Awd - DAC; 1st Ind, CofOrd to ACofS, G-4, 7 Apr 51; and 2d Ind, G4/E1-22673, G-4 to CofOrd, 17 Apr 51. ORDTU File, Jul 50 - May 51, MRB GSA FRC.

[56]All told, Ordnance received $3 million in FY 1951 funds, including $500,000 provided for the basic R&D contract, $2,100,000 requested in the supplemental budget, and $400,000 from the Industrial Division, OCO, for procurement of JATO units. "Project HONEST JOHN - TU2-1029 DOA #5-17-07-027-z" (Source and Distribution of Funds - FY 1951, compiled by Lt Col B. R. Lewis). ORDTU File, Jun 51 - Aug 51, MRB GSA FRC.

Table 1—(U) Composition of Honest John Program, FY 1951

Source & Nature of Supplies & Services		Estimated Cost
GOVERNMENT-FURNISHED EQUIPMENT & SERVICES[a/]		
Redstone Arsenal		
Tech Supervision (Salaries, Travel, etc.)	$ 15,483	
Loading 120 Spin Rkts (Thiokol Corp, Rst Div)	12,517	
Sub-Altms to other agencies for proj work	100,000	$ 128,000
Frankford Arsenal		
35 Modified FF-4106 Integrating Accelerometers and 70 Time Fuzes		45,000
Bureau of Ordnance, Department of the Navy		
Spotting Charges (Naval Ordnance Test Station)	$ 500	
JATO Units (Allegany Ballistics Laboratory)	400,000	400,500
Other		
Dev, Spin Rkt Propellant & Grain Design (Thiokol)		90,000
Guided Missile Section, Rocket Branch (ORDTU)		418,506
Contract Administration (LAOD)		17,222
Total Cost, Government-Furnished Equip & Services		$1,099,228
Total Cost, Douglas R&D Contract (ORD-22)		1,900,372[b/]
	GRAND TOTAL	$2,999,600

[a/] Funds transferred to participating Ordnance agencies and installations by ORDTU RAD Orders; procurement of items from the Navy accomplished by Military Interdepartmental Purchase Request (MIPR).

[b/] Funds allocated to the LAOD by ORDTU RAD Orders.

SOURCE: (1) "Project HONEST JOHN - TU2-1029 DOA #5-17-07-027-z" (Source and Distribution of Funds - FY 1951, compiled by Lt Col B. R. Lewis). (2) Ltr, CO, RSA, to Thiokol Corp., Redstone Div, 21 Dec 50, no sub. (3) RAD Order ORDTU 1-12963, 7 Mar 51; 1-13107, 24 May 51 (Allocation of funds to Redstone Arsenal). (4) Ltr, CofOrd to CO Frankford Arsenal, 22 Jun 51, sub: Proj TU2-1029, HJ.

convinced of the need for the Honest John rocket and therefore were opposed to the immediate commitment of funds for the full 30-round program. In July 1951, Major General Ward H. Maris, then the Deputy ACofS, G-4 for R&D, informed the Chief of Ordnance that the ACofS, G-3, was making a critical review of the requirement for a "large rocket of the performance characteristics that have been estimated for 'Honest John,'" and that the results of this study might possibly lead to "a determination that no requirement exists for this delivery vehicle." Furthermore, he indicated that the "contemplated extension" of the program exceeded the intent of the limited firings authorized on 21 August 1950. Referring to the memorandum of August 1950 and to the 15 free-flight (1236F) units included in the initial plan, he asserted:

> It is understood now that the program of rocket firings . . . contracted with the Douglas Aircraft Company is intended to include . . . a later series of 15 [Model 1236G] rockets . . . to be fired early in 1952. In view of the uncertainty of the . . . Army requirement for this means of delivering an atomic warhead, it is desired that the first phase of the program . . . be limited to . . . 15 rockets, with the understanding that the results of the first phase will be evaluated before final commitment is made to carry out the presently contemplated extension of this program. No FY 52 funds will be expended on this project without the expressed approval of the Deputy Assistant Chief of Staff, G-4 for Research and Development.[57]

(U) If this pronouncement constituted something less than an unequivocal vote of confidence in the Honest John rocket, it failed to alter the convictions of the Redstone-Douglas engineers, for they had already demonstrated the potential value of the system in a dramatically successful firing some 2 weeks earlier. It is the five-round flight test program and the subsequent reversal of the above policy decision to which this study now turns.

(U) Feasibility Demonstration Firings (U)

(U) In early June 1951, all eyes focused on the White Sands Proving Ground, for the future of the Honest John Project largely rested on the

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[57] DF, G4/F4-42667, to CofOrd, 12 Jul 51, sub: Rkt Dlvry of Atomic Whds. ORDTU File, Jun 51 - Aug 51, MRB GSA FRC.

outcome of the five flight tests about to be made there. With this small sampling, the Ordnance-Douglas team would have to prove—at least superficially—that the large but simple unguided rocket could in fact deliver a 1,500-pound payload to a range of 20,000 yards, with a range probable error of 300 yards or less and a dispersion or lateral error of not more than 10 mils or 200 yards at maximum range. Neither the developer nor the sponsor expected perfect performance in these initial field trials. The main objectives were to demonstrate the feasibility of the proposed design under actual flight conditions and to obtain engineering data for use in subsequent developmental effort.

(U) The physical characteristics of these early prototypes were essentially the same as those prescribed at the beginning of the design study.[58] Each round used a dummy head, or ballast, weighing 1,500 pounds. Eight auxiliary spin rockets were mounted in pairs on the nose support structure in such a manner as to cause the missile to rotate immediately upon leaving the launch rail, the required spin stabilization in flight being maintained by means of canted fins. The main power plant was the 4-DS-105,000, X202C6 JATO unit—a modified version of the Navy's X202C1 model. It used OV double base solid propellant cast in a 4-grain configuration, and was capable of producing a total impulse of 420,000 pound-seconds in a burning time of about 4.39 seconds.[59]

(U) The spin motors used an internal-burning, six-pointed star grain of T10E1 propellant manufactured by the Thiokol Corporation, Redstone Division. (The original spin rocket used JPL-117D propellant.) The propellant grain weighed about 1.6 pounds and measured 2.75 inches in diameter. Performance specifications called for a minimum thrust of 575 pounds and a burning duration of 0.40 to 0.45 seconds. Igniters

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[58] See preliminary rocket design requirements, p. 29.

[59] (1) Ltr, DAC to CofOrd, 28 Nov 50, sub: Prog Rept No. 1 on Model 1236F Arty Rkt. (2) Ltr, DAC to Chf, LAOD, 12 Jul 51, sub: Prog Rept #8, Model 1236F HJ. (3) Fact Sheet, Honest John Proj TU2-1029 - Flt Test Summary, Rounds 1 - 5, 29 Jun 51 - 7 Aug 51. All in HJ R&D Case Files, Box 14-9, RHA AMSC.

for the spin motors measured several inches in length and one-half inch in diameter.[60]

(U) The fuzing system for the 1236F units consisted of an integrating accelerometer and a 100-second timer, both designed and manufactured by the Frankford Arsenal to meet specified performance characteristics. The function of the integrating accelerometer—an arming mechanism based upon acceleration and time of the rocket in flight—was to register the total impulse obtained from the main power plant. The 100-second timing device was used to simulate altitude detonation or head burst. Spotting charges were mounted on the rocket to indicate operation of both the timing device and accelerometer.[61]

(U) Aside from being responsible for the design and final assembly of complete test units, the Douglas Aircraft Company furnished the rocket airframes, metal parts for the spin rockets, the rocket launcher, wind measurement equipment, and other sundry parts and fittings. The device for measuring exact wind conditions in the launch area consisted essentially of an automatic instrument which released balloons reasonably close to the line of trajectory. Bowen-Knapp cameras would then register the balloon position relative to the rocket during the first few hundred feet of flight, thereby recording the exact velocity and

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[60](1) Ltr, Rst 470/1689, CO, RSA, to Thiokol Corp., Redstone Div, 21 Dec 50. (2) Memo, Record of FONECON, H. L. Thackwell, Jr., Thiokol Corp., to Mr. Bartley, JPL, 18 Jan 51. (3) PR & Commitment Form, ORC 481-51, 24 Jan 51 [Pur of 40 Loaded Spin Rkts & Igniters, est cost $4,173.20] w/Incl, "Specification for Grain, Spin, Rocket, 2.75 inches." All in HJ R&D Case Files, Box 14-9, RHA AMSC.

[61](1) MFR, Casper J. Koeper, Chf, Design Sec, Ord Rkt Cen, 8 Feb 51, sub: Trip Rept on Trip Relative to Ord Proj TU2-1007D, 29 Jan thru 3 Feb 51 [Notes on Confs held at OCO, ABL, & M. W. Kellogg Co.]. (2) Memo, John W. Womble, HJ Proj Engr, to Chf, Projs Br, 3 Jul 51, sub: Visit to WSPG, 27 to 30 Jun 51 - Mr. C. J. Koeper & Mr. J. W. Womble - Ord Proj TU2-1029 HJ. Both in HJ R&D Case Files, Box 14-9, RHA AMSC.

direction of surface winds and providing the data needed to determine the effect of winds on range dispersion.[62]

(U) The non-tip-off, fixed-base, rail-type launcher provided for 30 feet of guided rocket travel at a launch angle, or quadrant elevation (QE), of 22.5°. It was fabricated to serve as an interim test firing platform and used a discarded Nike stand as its base. The Chief of Ordnance decided that the design of a tactical-type launcher should be held in abeyance pending a decision on the possible acceptance of the Honest John as a tactical weapon.[63]

(U) By 25 June 1951, the test crew had assembled the first test round and completed the dry runs preparatory to flight firing on 29 June. As originally planned, the succeeding four rounds were to be fired at 1-week intervals, beginning with Round 2 on 7 July and ending with Round 5 on 28 July. However, this schedule could not be met because of inadequate assembly space at the White Sands Proving Ground[64] and delays in motor delivery. The motor for Round 2 arrived nearly 2 weeks late, postponing the flight test to 18 July 1951. Subsequent firings

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[62](1) MFR, J. W. Womble to Chf Ord Rkt Cen, 4 Dec 50, sub: Sp Purpose Rkt Proj [Notes on Conf at OCO, 29 Nov 50]. (2) Ltr, DAC to LAOD, 28 Mar 51, sub: Prog Rept #5 on Model 1236F. Both in HJ R&D Case Files, Box 14-9, RHA AMSC.

[63](1) 1st Ind, 00 471.94/239, CofOrd to CO, RSA, 4 May 51, on Ltr, RIA 474.9/191, CO, RIA, to CofOrd, sub: Lchr for Rkt Model 1236F. ORDTU File, Jul 50 - May 51, MRB GSA FRC. (2) Fact Sheet, HJ Proj TU2-1029 - Flt Test Sum, Rds 1 - 5, 29 Jun 51 - 7 Aug 51. HJ R&D Case Files, Box 14-9, RHA AMSC.

[64]The assembly space assigned in Navy Building N-77 had to be shared with the Talos project and therefore made the Honest John program subject to the whims of the Navy. At times, the Honest John crew had to move the rocket outside to complete assembly work because the Navy had to use the building. (1) Ltr, Maj H. E. Whitmore, ROO, DAC, to CofOrd, 20 Aug 51, sub: WSPG Fac & Pers for HJ. (2) Memo, Chf, ORDTB-AB, to Chf, Ord R&D Div, 16 Aug 51, sub: Trip Rept of Capt Albert Clark to Sandia Corp. Both in ORDTU File, Jun 51 - Aug 51, MRB GSA FRC.

took place at 1-week intervals—25 July, 1 August, and 7 August, respectively.[65]

(U) As a general rule, a new missile system is not committed to full-scale flight tests until all components have been thoroughly bench tested and the aerodynamic design has undergone exhaustive laboratory and wind tunnel tests. The underlying objective of this policy is to work out as many engineering "bugs" as possible in the laboratory and thereby reduce the scope and cost of full-scale flight tests. Yet, the weapon system developer seldom achieves immediate success, even with adequate time and funds for exceptionally thorough laboratory work. On the contrary, the results of initial field trials very often refute scientific theories and send the design engineers back to their drawing boards with the pensive conclusion that "the terrible tragedy of science is the horrible murder of beautiful theories by ugly facts."[66]

(U) When one considers that the Ordnance-Douglas team had been allowed less than 9 months to design, develop, build, and assemble the initial test models, and that the tight time schedule and limited funds had restricted the functional testing of components to a bare minimum,[67] this phase of the Honest John program was undoubtedly the most successful and least expensive of any comparable effort in rocket development history. The results of the dramatic five-round demonstration not only established the technical feasibility of the large-caliber, free rocket as a highly accurate system, but also proved that complexity and expense

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[65](1) Ltr, Maj H. E. Whitmore, ROO, DAC, to CofOrd, 20 Aug 51, sub: WSPG Fac & Pers for HJ. (2) DF, 00 471.94/360, CofOrd to Chf, BuOrd, DN, 19 Jun 51, sub: Large Cal Fld Rkt - HJ, Proj TU2-1029. Both in ORDTU File, Jun 51 - Aug 51, MRB GSA FRC. (3) Ltr, DAC to LAOD, 12 Jul 51, sub: Prog Rept 8, Model 1236F HJ. HJ R&D Case Files, Box 14-9, RHA AMSC. (4) Also see Table 2, p. 44.

[66]Origin of quotation unknown; quoted in News Front, Vol. 6 (Sep 62), p. 15.

[67]Investigation of spin rocket performance, for example, had been limited to two test runs on a spin jig to check the manifold. Memo, Maj H. E. Whitmore, ROO, DAC, to Dir of Projs, RSA, 11 Dec 51, sub: Tests on Spin Rkts, HJ. HJ R&D Case Files, Box 14-9, RHA AMSC.

were not necessarily the criterion of sophistication, nor the sole road to reliability.

(U) While there were a few random failures in the timer and accelerometer circuit, motor performance was even better than expected and the test results indicated that all five rockets fell within or near acceptable accuracy limits. In the first firing, for example, the timer-spotting charge circuit failed to simulate the altitude detonation or air burst point, and the accelerometer failed to register motor performance. However, since the test results indicated good launcher, spin rocket, and motor performance, and since the altitude at desired range could be computed from trajectory data, the component failures were not considered serious and actually had little effect on the overall test objectives.[68]

(U) The first flight test was, in fact, one of the most successful of the series. Without correction for known nonstandard conditions, the performance of Round 1 had been estimated as follows: Peak altitude, 7,786 feet; impact range from launcher, 22,636 yards; deflection error or impact point, 48 yards east of the launcher setting. The missile reached an actual peak altitude of 8,000 feet, with impact occurring 22,495 yards downrange and only 5 yards west of, or off course from, the line of the launcher setting. Members of the field crew found parts of the missile scattered in a fan-shaped area about 340 yards farther downrange and the rest of the missile imbedded in a large crater.[69]

(U) Since these early prototypes were fired from an experimental launcher, nominally fixed in both azimuth and elevation, a fair picture of range dispersion could not be obtained solely from an analysis of

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[68](1) Fact Sheet, HJ Proj TU2-1029 - Flt Test Sum, Rds 1 - 5, 29 Jun 51 - 7 Aug 51. (2) Memo, John W. Womble, to Chf Projs Br, RSA, 3 Jul 51, sub: Visit to WSPG, 27 - 30 Jun 51 - Mr. C. J. Koeper and Mr. J. W. Womble - Ord Proj TU2-1029 HJ. Both in HJ R&D Case Files, Box 14-9, RHA AMSC.

[69]WSPG Firing Bulletin, Honest John Round #1, 29 Jun 51. HJ R&D Case Files, Box 14-9, RHA AMSC.

actual ground impacts. To present a clear statistical picture of system performance, the test engineers stripped or adjusted the surveyed positions for known nonstandard conditions, similar in many ways to the methods used in analyzing artillery projectiles of the gun-fired type. The object of the adjusted dispersion analysis was to strip out all possible error factors in search of the experimental ammunition dispersion, rather than the tactical or field dispersion which might result from fire control and aiming errors or from the lack of very accurate instrumentation. Hence, the test engineers evaluated known nonstandard conditions with the aid of elaborate meteorological instruments—atmospheric conditions, both at the surface and aloft, being sampled at the actual time of firing. Therefore, the stripped impact data were not necessarily descriptive of tactical dispersion, where, for instance, atmospheric conditions must be sampled considerably before shoot time and possibly with comparatively crude instruments.

(U) Also affecting range dispersion, and therefore considered in the stripped analysis, were such factors as: thrust and mechanical malalignment; errors in launcher setting; and variations in empty and gross materiel weight, total impulse, burnt velocity, and center of gravity. Among the criteria established for determining the materiel correction factor were a standard empty weight of 3,850.0 pounds (without spin rockets or igniter) and a standard propellant or grain weight of 2,050.0 pounds.[70] Accordingly, the statistical analysis of the first five flight tests, shown in Table 2, includes two ground impact points: one based on actual survey and the other on stripped data.[71]

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[70] DAC Tech Memo MTM-406, Honest John Dispersion Bulletin No. 1, Rounds 1 - 13, 28 Dec 51. RSIC.

[71] A more detailed account of these and subsequent R&D flight tests is presented in the appendix.

Table 2—(U) Partial Summary of Honest John Feasibility Demonstration Firings

Round Number	Date Fired	Actual Ground Impact		Data Stripped for Known Nonstandard Conditions	
		Range (Yards)	Deflection (Yards)	Range (Yards)	Deflection (Yards)
1	29 Jun 51	22,495	5 west	21,074	159 west
2	18 Jul 51	21,648	189 west	20,622	137 west
3	25 Jul 51	21,749	12 east	20,320	9 west
4	1 Aug 51	21,453	124 west	20,185	134 west
5	7 Aug 51	21,738	227 east	20,345	40 east

SOURCE: "Honest John Data Summary Chart (OV Grain)," DAC, 18 Feb 53.

(U) Formal Development Program Established

(U) On 2 August 1951, before the feasibility demonstration firings had been completed and evaluated, the Secretary of the Army approved an Ordnance Technical Committee recommendation for the initiation of formal development effort with 1A priority. This action authorized the Chief of Ordnance to proceed with the first phase of the development program which had been defined and funded some 3 months earlier.[72] Specifically, the initial effort would consist of the design, fabrication, and flight test of 10 additional 1236F units, followed by a second phase consisting of 15 semicontrolled (1236G) units. However, pursuant to the restrictions imposed the month before by the Deputy ACofS, G-4 for R&D,[73] the final commitment to carry out the second phase was not to be made until results of the first phase had been evaluated.[74]

(U) The foregoing action was obviously premature, for it was already obsolete before the ink had dried. The original goal of the program had been to investigate system performance further and obtain sufficiently conclusive results to establish feasibility. However, the

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[72] See above, pp. 34 - 35, and Table 1, p. 36.

[73] See above, p. 37.

[74] OCM 33836, rev 11 Jul 51, appr 2 Aug 51, sub: Large Cal Fld Rkt (HJ)-Initiation of Dev. RSIC.

"unexpectedly successful results" of the first five firings dispelled the shroud of skepticism; and the feasibility of the system was "no longer seriously questioned."[75] The turning point came on 7 August 1951, when Secretary of the Army Frank Pace and other officials of the General Staff witnessed the fifth Honest John firing at White Sands Proving Ground.[76] Impressed with the simplicity and performance of the Honest John rocket, Secretary Pace immediately issued verbal instructions for maximum acceleration of the development program. Specifically, he instructed the Assistant Chief of Ordnance "to put HONEST JOHN on a crash basis" and to redirect the program as follows:

a. Have twenty-five 1236F rockets fired by 30 Sept 1951. This would be in addition to the five that have been fired to date.
b. Stop all work on the auto-pilot stabilized models, inasmuch as the present spin stabilized rockets appear to be sufficiently accurate.
c. Procure an additional forty 1236F rockets, with authorization for material purchases only, pending the outcome of further firing tests.
d. Coordinate with proper individuals in other agencies to provide the required warheads as expeditiously as practicable.
e. Fire a number of the twenty-five rockets (paragraph a above) with "hot heads."[77]

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[75] Memo, G4/F1-60574, Maj Gen Ward H. Maris, Dep ACofS, G-4 for R&D, for Chmn, RDB, 24 Sep 51, sub: Req for Allocation from the FY 1952 SECDEF Emergency Fund. ORDTU File, Sep 51 - 30 Nov 51, MRB GSA FRC.

[76] (1) ORDTU Daily Rept to Chf of R&D, 1 Aug 51. ORDTU File, Jun 51 - Aug 51, MRB GSA FRC. (2) Memo, J. W. Womble, to Chf, Proj Sec, RSA, 8 Aug 51, sub: ... Trip Rept on Visit to WSPG, N.M. on 6 & 7 Aug 51; w/Incl, Newspaper Clipping (unidentified). HJ R&D Case Files, Box 14-9, RHA AMSC. (Among those present at the demonstration were: Mr. Karl R. Bendetsen, Assistant Secretary of the Army; Brig. Gen. Stanley R. Mickelsen, Deputy ACofS for Guided Missiles; Maj. Gen. Ward H. Maris, Deputy ACofS for R&D; Brig. Gen. Herbert B. Loper, Chief, Armed Forces Special Weapons Project; and Brig. Gen. Leslie E. Simon, Chief, R&D Division, OCO, and Asst CofOrd.)

[77] (1) "History of HONEST JOHN," 23 Aug 51. ORDTU File, Jun 51 - Aug 51, MRB GSA FRC. (2) Also see HJ Blue Book, p. 51. (3) In connection with this drastic shift in program direction, it is interesting to note that four highly successful firings had already been made when the restricted development program was approved on 2 August. Equally significant, perhaps, is the fact that the fifth test firing, though basically successful, was the least accurate of the series. (See Table 2.) If it can be assumed here that Secretary Pace had not (Cont on next page)

(U) By mid-August 1951, the Chief of Ordnance had taken the necessary actions to place the Honest John program on a crash basis and to effect redirection of the program effort pursuant to these instructions.[78] In a patently anticlimactic action, on 21 August 1951, the Acting Deputy ACofS, G-4 for R&D, lifted the program restrictions that had been imposed by his office in July,[79] and urged the Chief of Ordnance "to push this program vigorously with a view to an early determination of the rate of spin necessary in this large rocket to achieve the accuracy required for atomic weapon support of ground forces."[80]

(U) The Ordnance Subcommittee on Rockets and Launchers completed its proposed revision of the rocket development plan (Project TU2-1029) on 21 September 1951—less than a month after receipt of tentative requirements from the Army Field Forces. But this plan was not approved by the Ordnance Technical Committee until mid-January 1952, and final approval by the General Staff came in a separate action more than a month later.[81] Meanwhile, the subcommittee received the tentative military characteristics for launching and handling equipment, in October, and immediately recommended the initiation of development under Ordnance Project TU2-3008, with 1A priority. Final approval of this action came at the end of February 1952.[82]

(U) Some 2 weeks earlier, on 12 February, the Chief of the Army Field Forces sent the General Staff a detailed set of proposed military

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(Cont from p. 45.) been fully apprised of the success achieved in earlier firings—and the verbal, on-the-spot decision lends some credence to this assumption—it would appear that his personal observation of the fifth firing was directly responsible for the sudden shift in technical approach and emphasis.

[78] Memo, Brig Gen L. E. Simon, Asst CofOrd, for Mr. Pace, SA, 16 Aug 51, sub: The Accelerated "Honest John" Program.

[79] See above, p. 37.

[80] DF, G4/F4-51369, to CofOrd, 21 Aug 51, sub: Rkt Dlvry of Atomic Whds. ORDTU File, Jun 51 - Aug 51, MRB GSA FRC.

[81] OCM 34061, 17 Jan 52; OCM 34119, 28 Feb 52. RSIC.

[82] OCM 34118, 28 Feb 52. RSIC.

characteristics for both the Honest John rocket and ground equipment.[83] The Ordnance Technical Committee approved the statement of detailed military characteristics in a meeting held on 20 November 1952. The General Staff finally approved the action with some changes on 12 February 1953—exactly a year after submission by the Army Field Forces.[84]

(U) While the official project plans thus filtered slowly through the Pentagon, the responsible Ordnance Corps agencies and contractors proceeded posthaste with weapon system development without the benefit of clearly defined technical guidance. This highly accelerated phase of the Honest John program resulted in the basic or interim tactical weapon system, which embraced the M31, 762-mm. rocket and the M289 self-propelled (truck-mounted) launcher with associated handling equipment.

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[83] Ltr, ATDEV-10 471.94/300, OCAFF to ACofS, G-4, 12 Feb 52, sub: Proposed MC's for a Large Cal Sp Purpose Fld Rkt with Lchr, Fire Control & Ammo Hdlg Equip. ORDTU File, Dec 51 - Feb 52, MRB GSA FRC.

[84] OCM 34490, 20 Nov 52; OCM 34615, 12 Feb 53. RSIC.

CHAPTER III

(U) IMPLEMENTATION OF THE ACCELERATED PROGRAM (U)

(U) Pursuant to verbal instructions of the Secretary of the Army, the Chief of Ordnance placed the Honest John program on a crash basis, as of 9 August 1951 (two days after the last demonstration firing), and promptly redirected the development effort accordingly. The original development plan, approved and funded in May 1951, had embraced the fabrication and test of 25 rockets: 10 of them to be identical in design to the five 1236F unguided, spin-stabilized rockets then being readied for feasibility demonstration firings; the other 15 to be the semicontrolled design, Model 1236G.[1] To implement the accelerated program, the Chief of Ordnance directed that the Douglas Aircraft Company suspend fabrication of the 15 Model 1236G rockets, and in lieu thereof fabricate a like number of 1236F units, the entire order of 25 rockets (Rounds 6 through 30) to be delivered and fired by 30 September 1951. In view of this stepped-up firing schedule, he also authorized the contractor to build a second fixed-base R&D launcher for delivery by 20 September 1951, so that two rockets could be fired simultaneously. At the same time, he directed the Los Angeles Ordnance District to proceed with the procurement of materials for later fabrication of 40 additional 1236F rockets.[2]

(U) Under the accelerated development plan thus adopted, flight tests of the 25 1236F rockets were to be completed by 30 September 1951, the prime objective being to investigate performance of the slow-spin rocket. Assuming satisfactory performance of these rounds, the 40 additional 1236F rockets would then be fired to obtain further development and ballistic data. Parallel actions would be taken to procure a number of tactical prototypes for engineering-user tests and to execute

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[1] See pp. 34 - 35, 44 - 45.

[2] (1) TT ORD-17075, CofOrd to LAOD, 9 Aug 51. (2) TT ORD-17137, CofOrd to LAOD, 10 Aug 51. Both in ORDTU File, Jan - Aug 51, MRB GSA FRC. (3) 1st Ind, CofOrd to LAOD, 10 Aug 51, on Ltr, LAOD to CofOrd, sub: Contr DA-04-495-ORD-22, Proj TU2-1029 (HJ)(DAC). HJ R&D Case Files, Box 14-9, RHA AMSC.

production engineering and industrial contracts.[3]

(U) Contractual Arrangements (U)

(U) For Crash Program on Rocket Airframes and JATO Units

(U) The Douglas Aircraft Company began work on the conversion of 1236G rockets, in mid-August 1951, under a change order to the basic contract. A letter agreement, signed with the company on 29 August, authorized $200,000 for procurement of material for the 40 additional 1236F rockets. The formal agreement, signed in mid-November 1951 authorized $608,515.99 (including above material cost) for the manufacture of 40 sets of rocket airframes, with delivery to begin in December 1951 and be completed by 1 March 1952.[4]

(U) Realizing that the M. W. Kellogg Company and the Allegany Ballistics Laboratory would not be able to supply the quantity of JATO units needed to meet the crash schedule, the R&D Division, OCO, established a new source of supply for both JATO metal parts and propellant charges. In the fall of 1951, it selected the Burnham Corporation, at Irvington, New York, as the new source of booster cases and began the reactivation of Government-owned facilities at Radford Arsenal, Virginia, for production and loading of propellant charges. The latter facility, operated by the Hercules Powder Company of Wilmington, Delaware, was expected to be in operation by February 1952 and have sufficient molds to fabricate and deliver 3,500 rocket charges by July 1952.[5]

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[3]Memo, ACofOrd for Mr. Pace, SA, 16 Aug 51, sub: The Accelerated HJ Program. ORDTU File, Jun - Aug 51, MRB GSA FRC.

[4](1) Ltr, Chf, LAOD, thru CO, RSA, and CofOrd, to ACofS, G-4, 10 Oct 51, sub: Req for Appr of Awd of Suppl Agmt to Formalize a Ltr Suppl and Enlarge Scope of Work Under Contr DA-04-495-ORD-22, DAC; and 1st Ind, G4/E1-70520, G-4, to CofOrd, 14 Nov 51. ORDTU File, Sep - Nov 51, MRB GSA FRC. (2) HJ Blue Book, p. 8. (3) Suppl 6, 16 Nov 51, included a net reduction of $347,963, resulting from conversion of the 1236G rockets to the cheaper 1236F design. The total contract value thus decreased from $1,900,372.19 (Suppl 3, May 51) to $1,752,409.19 (Suppl 6, Nov 51).

[5](1) Memo, Chf, ORDTU, to Chf, ORDIM, 13 Sep 51, sub: Actvn of Radford Fac for Pdn of Cast Double Base Propellants. (2) TT ORD-20840, OCO-ORDTU to Dist Chf, NYOD, 26 Sep 51. Both in ORDTU File, Sep - Nov 51, MRB GSA FRC.

(U) To expedite the procurement of vital materials for fabrication of the 40 additional booster cases needed under the accelerated development program, the New York Ordnance District awarded the Burnham Corporation a noncompetitive letter contract for $112,700, in October 1951, with the intention of executing a formal contract for $225,400 within 120 days. The formal contract, approved and signed in February 1952, called for four additional sets of booster cases, together with 44 crates and other services and supplies, at an estimated cost of $43,796, thus increasing the total contract value to $269,196.[6]

(U) The Radford Arsenal, however, was unable to commence propellant production by the target date of February 1952 because of difficulties in locating critical materials for fabrication of molds and because of apparent confusion concerning relative priorities of competing programs.[7] As a stop-gap measure, the Chief of Ordnance therefore re-established a requirement for propellant production at the Allegany Ballistics Laboratory. Following completion of an existing order for 35 grains early in March 1952, the Navy's Bureau of Ordnance promised delivery of 40 additional grains at the rate of six per month, beginning in April.[8]

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[6](1) Cmt 2, G4/E1-62972, ACofS, G-4, to CofOrd, 15 Oct 51, on DF, CofOrd to G-4, 9 Oct 51, sub: Req for Auth to Awd Ltr Contr to Burnham Corp. (2) Ltr, 00 471.94/685, CofOrd to NYOD, 16 Oct 51, sub: Issuance of LO for Large Cal Fld Rkt, Proj TU2-1029, DA Pri 1A. Both in ORDTU File, Sep - Nov 51, MRB GSA FRC. (3) 2d Ind, G4/E1-3807, ACofS, G-4, to CofOrd, 1 Feb 52, on Ltr, NYOD, thru CofOrd, to ACofS, G-4, 8 Jan 52, sub: Req for Appr of a Proposed Awd in the Amt of $269,196, ... Suppl Agmt No. 2 to Ltr Contr DA-30-069-ORD-505 with Burnham Corp. ORDTU File, Dec 51 - Feb 52, MRB GSA FRC.

[7]Ltr, CG, OAC, to CO, RSA, 15 Feb 52, sub: Ord Proj TU2-1029-HJ-Pri 1A, JATO, 4-DS-105,000, X202C6 Grains. ORDTU File, Dec 51 - Feb 52, MRB GSA FRC.

[8](1) Ltr, CofOrd to CO, RSA, 25 Feb 52, sub: Propellant Molds for HJ; 00 471.9/1448. ORDTU File, Dec 51 - Feb 52, MRB GSA FRC. (2) Ltr, CofOrd to CO, RSA, 7 Mar 52, sub: Program Scd - HJ Proj TU2-1029, DA Pri 1A; 00 471.9/1531, RSA 470/383. HJ R&D Case Files, Box 14-9, RHA AMSC.

(U) The Hercules Powder Company signed a contract for production of 180 propellant charges in late March 1952;[9] but the first set of molds was not delivered to Radford Arsenal until early June. The casting of two grains per week started 2 weeks later.[10] As of 28 July, only three molds were on hand at Radford Arsenal, with six more scheduled to arrive early in August. Delivery of the remaining 33 molds was expected by the end of September 1952, at which time the production capacity would reach 28 grains per week.[11]

(~~FOUO~~ U) For Additional Test Rockets (U)

(~~FOUO~~ U) Meanwhile, action had been taken to procure 130 additional 1236F rockets which were to be available upon completion of the 70 development and ballistic test firings. A supplemental contract agreement in the amount of $1,171,506, signed with the Douglas Aircraft Company in late April 1952, called for the manufacture of 130 sets of Type II, Model 1236F components suitable for use with the Government-furnished X202C6 (M6) JATO unit. Fifteen of these (Group 1) were to be complete sets with inert warheads, for use in testing the tactical launcher, transporter, and handling equipment under development at the Rock Island Arsenal. Group 2 consisted of 10 sets without ballast and telemetry, for use in blast and fragmentation warhead tests; the remaining 105 sets (Group 3) were to consist of the fin, fin fairing, and pedestal only, these being earmarked for "Special" warhead tests. Other

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[9] Suppl Agmt 21 of Contr W-11-173-ORD-37, 20 Mar 52. (The basic contract had been in effect since 13 April 1949 and covered production of various types of gun and rocket propellants for Army weapons. Supplement 21 provided funds for reactivation of cast propellant facilities for Honest John, including $864,925 for production equipment and $501,120 for 180 propellant charges. This, together with propellant orders for other systems, totaled $9,979,006.27.)

[10] MFR, 6 Jun 52, sub: Ord Proj TU2-1029, HJ, FONECON Btwn Lt Col W. C. Ohl, OCO, and Mr. J. W. Womble, John A. Robins, RSA, on 6 Jun 52, Propellant Grain; Data confirmed by TT ORDDW-TR-155, CG, RSA, to CofOrd, 10 Jun 52. HJ R&D Case Files, Box 14-9, RHA AMSC.

[11] Ltr, OO 471.9/2576, CofOrd to CO, RSA, 28 Jul 52, sub: HJ Propellant Pdn at RA; HJ R&D Case Files, Box 14-9, RHA AMSC.

items included in the contract were four sets of Type I spares, and 50 spin rockets with 35 nozzle sets for use in functional tests.[12]

(U) For Additional JATO Cases

(U) The Redstone Arsenal began parallel negotiations for the manufacture of additional JATO cases early in 1952. In its proposal for 28 sets of metal parts, submitted in February, the Burnham Corporation quoted a substantially higher unit price ($6,600 in contrast to $5,635 each for the first 44 sets), on the grounds that the original proposal had been too low.[13] For the next 120 units, the Redstone Arsenal solicited competitive bids from Burnham and several other equally qualified contractors.[14] This time the Burnham Corporation quoted a unit price equal to that agreed to in the basic contract, but only if it received the order for the total lot of 148 sets. Despite a much lower bid from the Barium Steel Corporation,[15] and over strong objections interposed by Redstone officials, Mr. H. G. Jones, Chief of the Rocket Branch of the R&D Division, OCO, directed that the entire order of 148 units be given to the Burnham Corporation.[16]

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[12](1) Ltr, CO, RSA, to Chf, LAOD, 28 Jan 52, sub: Ord Proj TU2-1029, HJ DAC Contr DA-04-495-ORD-22. HJ R&D Case Files, Box 14-9, RHA AMSC. (2) Ltr, LAOD, thru CO, RSA, and CofOrd, to ACofS, G-4, 8 Apr 52, sub: Req for Appr of Awd of Suppl Agmt to Enlarge the Scope of Work and Inc the Est Cost and Fxd Fee of Contr DA-04-495-ORD-22, DAC; and 2d Ind, G4/E1-26133, ACofS, G-4, to CofOrd, 23 Apr 52. HJ R&D Case Files, Box 14-8, RHA AMSC. (3) HJ Blue Book, p. 8. (4) Suppl Agmt 7, signed on 28 Apr 1952, increased the total value of the R&D contract from $1,752,409.19 to $2,923,915.19.

[13]TT, Chf, NYOD, to CO, RSA, 12 Feb 52. HJ R&D Case Files, Box 14-9, RHA AMSC.

[14]Ltr, CO, RSA, to NYOD, 14 Feb 52, sub: Ord Proj TU2-1029, DA Pri 1A, JATO Proc. HJ R&D Case Files, Box 14-9, RHA AMSC.

[15]Barium's bid for 120 units (plus 120 crates and five extra nozzles) came to $669,274; the Burnham bid for the same number of units amounted to $733,730—the difference of $64,456 being enough to buy nearly 12 sets of JATO parts, less extra nozzles, at the Barium price. (1) Ltr, Barium Steel Corp. to NYOD, 28 Feb 52. (2) Ltr, Burnham Corp. to NYOD, 4 Mar 52. Both in HJ R&D Case Files, Box 14-9, RHA AMSC.

[16]MFR, 28 Feb 52, sub: Proj TU2-1029 - HJ Booster Proc. HJ R&D Case Files, Box 14-9, RHA AMSC.

(U) In May 1952, the General Staff approved the award of a supplemental agreement for $906,640, increasing the total contract value to $1,175,836 and the total number of JATO units from 44 to 192.[17] The Redstone Arsenal proceeded with subsequent procurement of R&D test motors with no attempt to introduce competition. The Burnham contract was later increased by $516,002 to cover 95 more sets of metal parts, increasing the total contract to $1,691,838 and the number of JATO units from 192 to 287.[18]

(U) For Production Engineering Study and Limited Procurement (U)

(U) Meantime, the accelerated timetable for the 25-round flight test program had undergone substantial deceleration because of certain production bottlenecks. The last firing in this series took place in late May 1952—nearly 8 months behind schedule; flight test of the remaining 44 Type I rockets then began and most of them had been fired by mid-November.[19]

(U) With only 38 of the 74 development and ballistic tests completed by the end of June 1952, the Ordnance Corps had executed contracts for a production engineering study and limited industrial procurement. The Chief of Ordnance had approved a plan, in February 1952, whereby the production engineering study and initial production effort would be

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[17] 2d Ind, G4/E1-31923, ACofS, G-4, to CofOrd, 23 May 52, on Ltr, Dist Chf, NYOD, thru CofOrd, to ACofS, G-4, 1 May 52, sub: Req for Appr of Proposed Awd in the Amt of $906,640 to Burnham Corp., Covering Proposed Suppl Agmt 3 to Contr DA-30-069-ORD-505. ORDTU File, May 52, MRB GSA FRC.

[18] (1) 2d Ind, G4/E1-33105, ACofS, G-4, to CofOrd, 27 May 52, on Ltr, Chf, NYOD, thru CofOrd, to G-4, 14 May 52, sub: Req for Appr of ... Awd in the Amt of $246,444 to Burnham Corp., Covering ... Suppl Agmt 4 to Contr DA-30-069-ORD-505. ORDTU File, May 52, MRB GSA FRC. (2) Ltr, Chf, NYOD, to CG, RSA, 19 Nov 52, sub: Contr DA-30-069-ORD-505 with Burnham Corp. HJ R&D Case Files, Box 14-9, RHA AMSC.

[19] (1) HJ Data Sum Chart (OV Grain), DAC, 18 Feb 53. (2) HJ Data Sum Chart (OIO Grain), DAC, Rev 26 Feb 53. Both in HJ R&D Case Files, Box 14-9, RHA AMSC. (3) For discussion of early problems and delays, see below, pp. 66 - 75.

contracted out on an open competitive basis; however, pressure applied by the Douglas Aircraft Company soon changed all this. Upon hearing of the plan, Mr. F. W. Conant, Vice President in charge of manufacture, called Major General A. B. Quinton, Jr., the Deputy Chief of Ordnance, and informed him that unless the Douglas Aircraft was awarded the production study and any initial production for the Honest John, it would immediately pull out of all work on the project. This ultimatum placed Ordnance officials in the unpalatable position of choosing between two agonizing alternatives: they could proceed as planned and risk a minimum delay of 18 months in the Honest John program; or they could quietly submit to a subtle form of blackmail and avoid an interruption in R&D work which was already running behind schedule. Realizing that an extended delay would place the entire project in jeopardy, they sacrificed principle for expediency and chose the latter course. In late March, Colonel W. M. Tisdale of the Industrial Division, OCO, instructed the Redstone Arsenal to direct both contracts to the Douglas Aircraft Company, but emphasized that future production would be handled on a competitive basis.[20]

(U) The production engineering contract, signed on 2 June 1952 for $1,691,772 (including a fixed fee of $95,760), provided for studies of development design drawings and specifications, adapting them to modern production methods, eliminating costly and less efficient methods, and reducing the use of critical materials. It also called for the manufacture and delivery of 50 prototypes of the final redesigned rocket, to be designated as the Type III 1236F Honest John.[21] The contract was later

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[20](1) 1st Ind, 00 471.9/1318, CofOrd to CO, RSA, 11 Feb 52, on Ltr, CO, RSA, to CofOrd, sub: HJ Pdn Study. ORDTU File, Dec 51 - Feb 52, MRB GSA FRC. (2) MFR, Col Petrolino, 14 Mar 52. (3) MFR, Lt Col W. C. Ohl, 4 Apr 52. (4) TT ORD-10311, CofOrd to CO, RSA, sub: HJ Pdn Study, 20 Mar 52. Last three docs in ORDTU File, Mar - Apr 52, MRB GSA FRC.

[21]"Douglas Aircraft Company, Inc. - Honest John Production Engineering Study, Model 1236F - Contract DA-04-495-ORD-328." (This paper contains a summary of pertinent facts relating to the contract and an extract of Article 1, as amended by Supplement 1.)

completed and closed out with a net expenditure of $1,595,773.[22]

(U) In late March 1952, the ACofS, G-4, had approved a limited production requirement for 340 Honest John rockets, with a view toward creating a limited operational capability for five Honest John batteries by January 1953.[23] By mid-June, however, the unit cost of the missile had increased from about $15,000 to $20,000, and funds were not available to cover the entire lot. The General Staff therefore reduced the initial procurement from 340 to 243, 40 of which were to be procured under the R&D contract for use in testing warheads and providing flight data for the complete rocket.[24]

(U) The limited production contract thus signed with the Douglas Aircraft Company on 16 June 1952 provided $3,774,978 (including a fixed fee of $213,678) for the fabrication and delivery of 203 sets of metal parts (Model 1236F airframes), these units to be based upon the best design information available under the R&D contract. A supplemental agreement to this contract, signed on 28 June 1952, increased the number of rounds from 203 to 219, the 16 additional units being procured for user tests which were scheduled to begin in January 1953. This increased the total value of the industrial contract to $4,018,333. The first 16 (user test) rounds were to be delivered by 1 January 1953; the next 20

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[22] Closed Out Contract Listings, 1 Jul 63, AMICOM, p. 3.

[23] (1) Cmt 2, G4/R4-19152, G-4 to CofOrd, 26 Mar 52, on DF, G-3 to G-4, 24 Mar 52, sub: Limited Pdn of HJ Msls & Ancillary Equip. ORDTU File, Mar - Apr 52, MRB GSA FRC. (2) As will be noted later, the initial operational capability was changed to eight reduced-strength batteries and these were not fully equipped until June 1954.

[24] (1) DF, OO 471.9/2293, CofOrd to ACofS, G-4, 13 Jun 52, sub: Prog of Limited Pdn of HJ Msls & Ancillary Equip. ORDTU File, Jul - Aug 52, MRB GSA FRC. (2) HJ Blue Book, p. 52.

rounds were to be available for T2020 chemical warhead tests by 1 February 1953.[25]

(U) The 40 rockets for R&D purposes (mentioned in the above industrial procurement plan) were procured by Supplemental Agreement 8 to the basic R&D contract on 16 June 1952. These additional units were to be identical in design to the Type II rockets already on order, with the exception of the hinged nose, accelerometer spotting charge installation, and provisions for the Sandia warhead trailer attachment. In addition to providing $344,432 for these 40 units, the supplemental agreement also included $262,514 for the design, fabrication, and delivery of one prototype trailer-mounted launcher, increasing the total value of the R&D contract to $3,530,223.19.[26]

(U) For FY 1953 Procurement (U)

(U) As originally planned, the foregoing limited procurement for R&D purposes in FY 1952 was to be followed by volume procurement in FY 1953. The approved program, issued to the Redstone Arsenal in late October 1952, allotted $29,400,000 for procurement of 2,000 complete Honest John rockets at a unit price of $14,700, production deliveries to start the first month in FY 1954 and extend into the first half of FY 1955. In view of the excessively high 1952 procurement price of $20,000 per round, the Industrial Division, OCO, decided to handle 1953

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[25](1) "Douglas Aircraft Company, Inc. - HJ, Industrial Contract DA-04-495-ORD-342." (This paper contains a summary of pertinent facts relating to the contract and the circumstances under which awarded.) (2) Memo, Chf, Rkt Dev Gp, RSA, to Dir, OML, 13 Nov 52, sub: Ord Proj TU2-1029 - HJ - Diversion of Pdn Rds to R&D. HJ R&D Case Files, Box 14-9, RHA AMSC. (3) Memo, Chf, Rkt Dev Gp, to Dir, OML, 25 Nov 52, sub: Ord Proj TU2-1029, HJ Dlvry Scds. ORDTU File, Nov - Dec 52, MRB GSA FRC.

[26](1) HJ Blue Book, p. 8. (2) Ltr, Chf, LAOD, thru CofOrd, to ACofS, G-4, 23 May 52, sub: Req for Appr of Awd of Suppl Agmt to Enlarge the Scope of Work and Inc the Est Cost and Fxd Fee of Contr DA-04-495-ORD-22, DAC. HJ R&D Case Files, Box 14-8, RHA AMSC.

procurement on a competitive bid basis, rather than go directly to the Douglas Aircraft Company on a single contractor basis.[27]

(U) The Redstone Arsenal moved out on this abortive procurement exercise in November 1952—before the Type I development flight tests had been completed and evaluated. Since the complete round was to be assembled in the field by Ordnance Corps units, the components were broken down into three separate procurement groups. One of these consisted of JATO metal parts which were then being produced by the Burnham Corporation. The other two groups embraced components then being produced by the Douglas Aircraft Company: namely, the nose, fins, and fairing metal parts, and spin rocket metal parts.[28] The Redstone Board of Awards received competitive bids on all three groups in late January 1953. The Emerson Electric Company was the low bidder for the nose, fins, and fairing metal parts; Douligny, Inc., of Charlotte, North Carolina, submitted the low bid for spin rocket metal parts.[29] The Cameron Iron & Steel Works was the low bidder for the JATO metal parts; however, the board recommended that the S. D. Hicks & Son Company, Boston, Massachusetts, be given the award since it was a small business in a distressed labor area and it agreed to meet the low bidder's price.[30]

(U) By mid-February 1953, the Board of Awards had finished its work and submitted information to the Ordnance Districts for notification of successful bidders. At this point, the FY-1953 volume procurement

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[27] Ltr, CofOrd to CG, RSA, 29 Oct 52, sub: FY 53 Proc of HJ Rkts; Incl 1 thereto, Consolidated Proc Prog, 21 Oct 52. ORDTU File, Sep - Oct 52, MRB GSA FRC.

[28] The latter item was so separated because the Thiokol Corporation at Redstone Arsenal, Alabama, would continue to load the spin rockets and the Ordnance Corps wanted a metal parts producer nearer that location to save shipping costs. With metal parts then being produced at Santa Monica, Calif., the Government had to pay shipping charges from California to Alabama, thence to White Sands (Proving Ground), New Mexico.

[29] With reference to the foregoing footnote relative to shipping costs, note the straight shipping line from North Carolina to North Alabama, thence to New Mexico.

[30] Min of Conf on HJ Rkt, OCO, 8 Apr 53. ORDTU File, Mar - Apr 53, MRB GSA FRC.

exercise came to an abrupt halt; and Redstone's National Procurement Division braced itself for a repeat performance with only 4 months left to complete negotiations and obligate funds before the end of the fiscal year. Because of technical difficulties being encountered in engineering-user flight tests, Maj. Gen. Emerson L. Cummings, then Assistant Chief of Ordnance, concluded that technical progress on the Honest John was not sufficient to warrant full-scale production. After a thorough analysis of test results, he recommended, and the General Staff reluctantly agreed, that volume procurement should be cancelled and FY-1953 procurement limited to about 200 additional rounds which were to be produced by the Douglas Aircraft Company on an end-item basis. Meanwhile, the Ordnance Corps would conduct a series of special accuracy tests to determine the cause of large dispersion errors, and be prepared to recommend production of the remaining 1,800 rounds within 90 to 120 days.[31]

(U) Upon learning that it had not been selected for participation in the 2,000-round production program, the Douglas Aircraft Company had voiced sharp objections—apparently to Gen. Lyman L. Lemnitzer, then Deputy Chief of Staff for Plans and Research—on the grounds that this represented the first large production contract. In support of this decision, General Cummings explained that Douglas had been awarded contracts for the production engineering study and for production of the first 200 rounds, in 1952; but for the 2,000-round program, Douglas' bid for airframes was so far out of line ($3,972 against a low bid of $2,379) that it could not be seriously considered for the award. Even though the Ordnance Corps had already bent over backward to appease this contractor in an earlier transaction, General Lemnitzer emphasized that ". . . Douglas had a top-flight organization . . . and we should not

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[31] (1) Min of GM Coord Conf, OCO, 26 Feb 53. ORDTU File, Jan - Feb 53, MRB GSA FRC. (2) MFR, OCofS, DA, 23 Mar 53, sub: Proc of HJ Rkts, 20 Mar 53. ORDTU File, Mar - Apr 53, MRB GSA FRC.

antagonize them to the point where they will not work for us. . . ."[32]

(U) It soon became evident, however, that the Douglas Aircraft Company had been antagonized, for it was in something less than a cooperative mood when approached on the reduced 200-round production program. The Redstone Arsenal began negotiations, in April 1953, on the basis of a required delivery schedule of 35 to 40 rounds per month, beginning with termination of current production in August 1953 and continuing through January 1954.[33] Negotiations first broke down in late May, when Douglas refused to accept the required delivery schedule. The contractor insisted on 30 weeks' production lead time from date of contract, placing initial delivery in January 1954. This problem was hardly solved before Douglas raised another roadblock, in refusing to accept a standard contract clause requiring control of overtime by the contracting officer. The Arsenal managed to solve this problem by expedited action on 5 June, and negotiations were finally concluded a week later.[34]

(U) Supplements 2 and 3 to the production contract, signed on 11 June and 29 June 1953, respectively, called for 200 sets of Type II metal components with spare parts, eight Type II warhead compartments, and modification of packaging requirements, at a total estimated cost of $1,786,169. This increased the total contract value from $4,018,333 to $5,804,502, the latter including a fixed fee of $328,557.[35] Subsequent modifications to the contract resulted in a cost reduction of $1,754,247, leaving a net expenditure through close-out of $4,050,255.[36]

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[32](1) Ibid. (2) At the time of this discussion (20 March 1953), General Cummings was serving in a dual capacity as Assistant Chief of Ordnance, and Chief of the Industrial Division, OCO; he was named Chief of Ordnance in November 1953.

[33]Min of Conf on HJ Rkt, OCO, 8 Apr 53. ORDTU File, Mar - Apr 53, MRB GSA FRC.

[34]Cmt 2, 00 471.9/1153, ACofOrd to ACofS, G-4, 12 Jun 53, on DF, G4/F4-36527, G-4 to CofOrd, 11 Jun 53, sub: Proc of 200 HJ Rkts. ORDTU File, May - Jun 53, MRB GSA FRC.

[35]Sum of Ind Contr DA-04-495-ORD-342, DAC.

[36]Closed Out Contract Listing, AMICOM, 1 Jul 63, p. 3.

Most of the cost reduction centered around the initial 219-round order, the Douglas Aircraft Company reporting an underrun of $1,213,331 due to manufacturing improvements.[37]

(U) For Additional FY 1953 Development Work (U)

(U) Aside from the purchase of JATO units and other Government-furnished items for the above 200 production rounds, the Redstone Arsenal obligated nearly a half million dollars in FY 1953 for additional development and engineering effort at the Douglas Aircraft Company. At the end of June 1953, the scope of work under the R&D contract had been expanded to provide for test purposes 40 sets of Model 1236F metal components, 50 sets of spin rocket casings, and five sets of nose sections. Other development work financed in FY 1953 involved several derivations of the Model 1236F rocket, each designed to fulfill a specific function. One of these, the Father John, was a standard round with auxiliary Deacon rockets strapped to the motor body for over-acceleration test of XW-7 atomic warhead components. Another design was the 2-stage Model 1236FF rocket—originally intended as an overtest vehicle for XW-7 components, but later used as a possible means of increasing the range of the Honest John. Conversely, a third design—later designated as the Demijohn—used spoilers or drag brakes on the standard 1236F rocket to reduce the minimum range from 10,000 to 5,000 yards.[38]

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[37] (1) Memo, ORDTU to Chf, ORDIM-SWSS, 13 Jul 53, sub: Contr ORD-342, DAC, HJ. ORDTU File, Jul - Sep 53, MRB GSA FRC. (2) In the contract summary cited in footnote 35, Captain Fleagle, ORDIM-GMSS, stated that Douglas refunded the $1.2 million but with no adjustment in fixed fee; indicating that the Army paid Douglas a 6% profit of $213,678 on the full estimate of $3,561,300, which was reduced by more than one-third without a commensurate reduction in fee. There is a chance that this adjustment was included in the total reduction at contract close-out. If not, the Army simply paid Douglas a profit of some $72,800 (6% of 1,213,331) on money refunded and in excess of work actually performed.

[38] (1) HJ Blue Book, pp. 10 - 11. (2) Sum of HJ R&D Contr DA-04-495-ORD-22, DAC. According to this summary, the R&D work funded in FY 1953 and covered in Supplemental Agreements 9 thru 13, amounted to $432,869, increasing the total contract value from $3,530,223.19 to $3,963,092.19. The funds committed to the three Douglas contracts (ORD-22, ORD-342, and ORD-328), as of 30 June 1953, totaled $11,459,366.

(U) Type Classification of M31 Rocket (U)

(U) As the final drawings and specifications for the basic M31 rocket neared completion, in the early fall of 1953, developments in the Honest John program moved at a much faster, if ineffectual, pace. An evaluation of 20 special flight tests, completed in late June 1953, indicated that the technical deficiencies noted earlier in the year had been remedied and the rocket fully met the military characteristics established for it. In early August 1953, the Chief of Ordnance advised the General Staff that complete drawings and specifications would be available for industrial release by 1 September 1953, and requested that $27 million in FY-1954 funds be provided for the first volume procurement of 1,800 rockets. Since service tests could not be completed by the proposed release date, he also requested authority to proceed with this procurement before type classification (or standardization) of the M31 rocket.[39] For the better part of the next 2 months, progress on the program was hamstrung by conflicting decisions from the General Staff and the Army Field Forces.

(U) Brig. Gen. K. F. Hertford, the Assistant Deputy ACofS, G-4 for R&D, advised the Chief of Ordnance, in late August 1953, that the Honest John system had not yet proved completely satisfactory, but its "performance during test has . . . shown sufficient improvement over existing equipment to justify production and use." He noted, however, that a decision had been made to postpone further procurement pending standardization of the system. To this end, he suggested that the Ordnance Technical Committee initiate type classification action at its next meeting.[40] Just a week later, on 27 August, the committee action reached a dead end, when the Army Field Forces refused to concur on the grounds

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[39] DF, OO 471.9/1640, CofOrd to ACofS, G-4, 4 Aug 53, sub: Proc of HJ Rkts. ORDTU File, Jul - Sep 53, MRB GSA FRC.

[40] DF, G4/F4-51833, to CofOrd, 21 Aug 53, sub: Type Clas (Stdzn) of the HJ Sys. ORDTU File, Jul - Sep 53, MRB GSA FRC.

that it was contrary to their policy to accept a system as standard type before completion of service tests.[41]

(U) At that time, the Army Field Forces had at their disposal the results of 159 flight tests, including 79 tests of Type II tactical prototype rockets and ground equipment.[42] While a number of technical deficiencies had been noted in both the rocket and launching equipment, most of these had been corrected and further improvements in the system were well underway. But it seemed that some critics would never be completely satisfied, their opposition to the system continuing along the same lines as that voiced less than a year before: ". . . [There] is no requirement for Honest John, . . . it isn't any good, never had been and never would be satisfactory."[43]

(U) In the final analysis, the Army Field Forces' policy on type classification prevailed: acceptance of the Honest John as a standard item would have to await completion of service tests in 1954. Yet, the items of ground equipment necessary for eight reduced-strength batteries had already been placed in production, the delivery schedules as of mid-September 1953 calling for completion of the first four battery sets by 31 December 1953 and the other four by 30 April 1954, with initial

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[41](1) DF, 00 471.9/1814, ACofOrd to ACofS, G-4 for R&D, 28 Aug 53, sub: HJ Rkts - Clas as Std Type. (2) OCM 34956, 27 Aug 53, same sub. RSIC.

[42]Sum of HJ Data (OIO Grain), atchd as Incl to Ltr, CG, WSPG, to CofOrd, 10 Mar 54, sub: HJ Rkt Data. ORDTU File, Mar - May 54, MRB GSA FRC.

[43](1) Memo, Lt Col W. C. Ohl to Col E. H. Harrison, ORDTU-OCO, 14 Jan 53, sub: Atchd Rept of HJ Conf. ORDTU File, Jan - Feb 53, MRB GSA FRC. The opinion quoted from the cited memorandum was attributed to Col C. C. Duell, Army Field Forces Board No. 1. (2) Similar resistance to the Honest John continued long after the weapon system had been deployed. For example, in April 1955, an Artillery School instructor at Fort Bliss, Texas, touched off a heated controversy by making equally critical remarks about the Honest John in his lecture to a class of high-ranking Army officers and civilian members of the Department of Defense. Ltr, CofOrd to CG, WSPG, 20 Apr 55, sub: Instr, HJ Rkt Sys, GM Orien Crs, Ft Bliss, Tex. ORDTU File, Jan - Apr 55, MRB GSA FRC.

overseas deployment slated for 1 August 1954.[44] Clearly, volume production of the rocket could not be long delayed if there was to be a sufficient quantity on hand to support deployment schedules. To get the rocket into production, General Hertford finally type classified the M31 rocket as "substitute standard," pending completion of service tests, and approved the release of drawings for procurement of the 1,800 rounds in late September 1953.[45] The details relating to this phase of procurement belong in a later part of this study. For the moment it will suffice to say that the Douglas Aircraft Company continued its flight for the quantity production contract and succeeded in temporarily stalling procurement actions by imposing an ill-conceived legal restriction on Honest John drawings to prevent Ordnance from releasing them to other contractors.[46]

(U) Because of certain bottlenecks that developed in the production of ground equipment,[47] the first eight Honest John batteries were not fully equipped until 1 June 1954.[48] Meanwhile, upon completion of R&D flight tests in January 1954, the crew at White Sands conducted a series of complete weapon system tests using all tactical components and equipment. The results of these tests, completed early in 1954, indicated that the system was suitable for artillery operations and had very

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[44](1) DF, G4/F4-2781, Asst Dep ACofS, G-4 for R&D (Opns), to CofOrd, 15 Jan 54, sub: HJ Equip Delays. (2) DF, G4/F4-76744, Asst Dep ACofS, G-4 for R&D (Opns), to CofOrd, et al., 18 Jan 54, sub: Dplmt of HJ Btrys (Availability of Equip For). Both in ORDTU File, Jan - Feb 54, MRB GSA FRC.

[45](1) Cmt 2, G4/F4-52982, ACofS, G-4, to CofOrd, 30 Sep 53, sub: HJ Rkts - Clas as Std Type; recorded in OCM 35008, 7 Oct 53. RSIC. (2) DF, G4/H2-58033, G-4 to CofOrd, 23 Sep 53, sub: Proc of HJ; cited in OCM 35002, 7 Oct 53. RSIC.

[46]MFR, Lt Col James P. Hamill, 16 Nov 53. ORDTU File, Oct - Dec 53, MRB GSA FRC.

[47]See below, pp. 162 - 63.

[48]HJ Blue Book, p. 66.

good accuracy; however, there were certain areas in which considerable improvement could be made.[49]

(U) To carry out the necessary product improvement engineering, the Redstone Arsenal supplemented Douglas' R&D contract in the amount of $735,562 for the fabrication of six sets of spoilers for Demijohn test rounds, and 90 sets of metal components, less nose section, for use in the continuing effort to provide a suitable conventional warhead for the M31 rocket.[50] In this connection, it should be noted that the M31 rocket still did not have a suitable conventional warhead or fuze as late as July 1954; and the requirement for special items such as the Demijohn was established only after much confusion and protracted debate. Moreover, the high cost of the system and the urgency of the program had precluded adequate environmental testing, and provisions for the same still had not been made as of July 1954.[51]

(U) In the meantime, the results of service tests, which were continued after classification of the M31 rocket as substitute standard, led to the modification of several key components. By August 1954, combined engineering-user tests of the modified M31A1 rocket had been completed and the new components were ready for introduction in production items. Early in September 1954, the M31A1 Honest John Rocket—semifinal version of the Basic Weapon System—was type classified as standard, and the M31 rocket was redesignated as limited standard type.[52]

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[49](1) Ibid., pp. 65 & 66. (2) Annual Prog Rept, Large Cal Arty Rkt (HJ), 517-07-027, 31 Dec 54. ORDTU File, Sep - Dec 54, MRB GSA FRC.

[50](1) TT ARL-769, CofOrd to Chf, LAOD, Jun 54; TT 4298, CG, RSA, to CofOrd, 22 Jun 54. ORDTU File, Jun - Aug 54, MRB GSA FRC. (2) HJ Blue Book, p. 11. (3) According to the cited documents, Supplements 15 and 17, signed in the latter half of FY 1954, increased the total value of Contract ORD-22 from $3,963,092.19 to $4,698,654.19 as of 30 June 1954.

[51]Mary T. Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," (2 vols & suppl, RSA, 1 Jul 54), II, 152.

[52]OCM 35504, 9 Sep 54, RSIC.

(U) Delaying Factors in Accelerated Program (U)

(U) Lack of Technical Guidance (U)

(U) One of the prime deterrents to progress in the early months of the accelerated development program was the lack of firm technical guidance on user requirements. Firm military requirements naturally could not be established at the beginning of the program in 1950. But with the feasibility of the large-caliber, free rocket successfully established in August 1951, the user should at least have been in a position to provide reasonably detailed assumptions. This would have given the developer an interim goal toward which to work, and much confusion and wasted motion would have been eliminated.

(U) The Ordnance Technical Committee action approved by the General Staff on 2 August 1951 had simply authorized the initiation of a formal program for the development of a large-caliber field rocket capable of delivering a 1,500-pound payload to a range of not less than 20,000 yards with a deflection probable error not in excess of 10 mils and a range probable error of not more than 300 yards. It gave no detailed technical guidance, but instead repeated the skimpy preliminary design data which had been evolved from the initial theoretical analyses and feasibility studies.[53]

(U) The Chief of the Army Field Forces finally established a formal requirement for the Honest John rocket on 25 August 1951—nearly a month after the Chief of Ordnance had placed the program on a crash basis. This statement indicated the relative priority to be accorded the various types of warheads, but the military characteristics outlined for the rocket remained the same as those previously recorded under the heading of "preliminary design configuration." An Ordnance subcommittee action, initiated in September 1951 and approved by the Technical Committee in January 1952, recorded the above requirements; confirmed the accelerated

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[53] OCM 33836, "Large Caliber Field Rocket (Honest John)—Initiation of Development," 2 Aug 51. RSIC.

development plan (discussed in the preceding section); and assigned the major rocket components an official nomenclature.[54] The Army General Staff approved this action on 21 February 1952.[55]

(U) Meanwhile, the Chief of the Army Field Forces, on 12 February 1952, had sent the ACofS, G-4, a detailed set of proposed military characteristics for the rocket and ground equipment, and requested that a development project be initiated with an overall priority of 1A.[56] (This request, of course, was superfluous, for the Honest John development project had been initiated on a crash basis more than 6 months earlier.) By the time the detailed statement of proposed military characteristics became available in late April 1952, most of the 74 R&D rockets had been built, 29 of them had already been fired, and an order had been placed for the manufacture of 130 tactical prototypes. Up to this point, the project engineers at the Redstone Arsenal had been faced with the frustrating problem of "attempting to anticipate the military characteristics to be established by the Army Field Forces."[57]

(U) The revised statement of military characteristics—submitted to the Chief of Ordnance in April 1952 and finally approved by the General Staff in February 1953—contained several key changes in basic technical requirements. Among these was a reduction in the acceptable minimum range from 20,000 yards to 10,000 yards, the "required" maximum range being set at 30,000 yards. The original accuracy requirements (deflection probable error of not more than 10 mils; range probable error not

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[54] OCM 34061, Large Cal Fld Rkt, HJ - Stmt of Rqrmt & Asgmt of Nomen, 17 Jan 52. RSIC.

[55] Cmt 2, G4/F3-6034, ACofS, G-4, to CofOrd, 21 Feb 52, on DF, CofOrd to G-4, 23 Jan 52, sub: Large Cal Fld Rkt, HJ - Stmt of Rqrmt & Asgmt of Nomen; Recorded in OCM 34119, 28 Feb 52. RSIC.

[56] Ltr, ATDEV-10 471.94/300, sub: Proposed MC's for a Large Cal Sp Purpose Fld Rkt, with Lchr, Fire Control and Ammo Hdlg Equip; attached as Incl 1 to DF, G4/F3-10162, ACofS, G-4, to ACofS, G-3, 25 Feb 52, same sub. ORDTU File Mar - Apr 52, MRB GSA FRC.

[57] Memo, Fred B. Smith, Dep Chf, Rkt Dev Gp, to Dir, OML, 8 Dec 52, sub: Ord Proj TU2-1029 - HJ - Tech Supv. HJ R&D Case Files, Box 14-9, RHA AMSC.

in excess of 300 yards) were restated in more general terms; to wit: "The accuracy shall be the maximum practical. A circular probable error not to exceed 200 yards is highly desirable."[58]

(U) Equipment Problems

(U) If the lack of adequate technical guidance had been the only major problem encountered during these formative months, the accelerated timetable probably could have been met with relative ease; for the Chief of Ordnance had established what appeared to be an exceptionally smooth-running program, complete with measures to scotch potential delays and bottlenecks. Receiving first priority in the last 2 weeks of August were actions necessary to expedite delivery of rocket components in time to complete the 25-round test program by the stepped-up deadline of 30 September 1951. The source of supply for Government-furnished equipment had been established in May 1951; and the necessary funds had been provided in the supplemental budget for Fiscal Year 1951.[59] With this advanced programming, the chances of meeting the accelerated delivery schedules originally appeared to be very good in all but one area.

(U) The most serious potential bottleneck centered around the supply of booster cases. Because of early problems and delays in this area, the Chief of Ordnance had completed procurement action, through the Navy's Bureau of Ordnance, for 20 JATO units (in addition to the 15 already on order), as early as February 1951; but a firm commitment for delivery of these units at the rate of one per week was not requested until mid-June 1951.[60] Early in August 1951, the Bureau of Ordnance informed the Ordnance Corps that the accelerated delivery schedule could

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[58] OCM 34490, 20 Nov 52; OCM 34615 (Staff appr of Item 34490), 12 Feb 53. RSIC.

[59] For details see above, pp. 34 - 36.

[60] (1) DF, 00 471.94/246, CofOrd to Chf, BuOrd, DN, 28 Feb 51, sub: JATO's 4-DS-105,000. (2) Ltr, 00 471.94/360, CofOrd to Chf, BuOrd, 19 Jun 51, sub: Large Cal Fld Rkt - HJ Proj TU2-1029. Both in ORDTU File, Jun - Aug 51, MRB GSA FRC.

not be met because of a lack of machining capacity at the M. W. Kellogg Company; however, it appeared that this deficiency could be made up by machining a part of the cases at the Watertown Arsenal. At any rate, Brig. Gen. Leslie E. Simon, then Assistant Chief of Ordnance, urged the Bureau of Ordnance to take whatever action necessary to assure delivery of 25 JATO units by 31 August 1951. Realizing that propellant production at the Allegany Ballistics Laboratory (a Navy installation) might also fall behind schedule, he advised the Secretary of the Army that an overriding priority would be required for the small stock of powder grains then on hand and for additional molds to expedite production.[61]

(U) In late August 1951, the Rocket Branch of the R&D Division, OCO, ordered additional propellant mold castings to increase production capacity and arranged to have them machined at the Watertown Arsenal, but the progress made in expediting delivery of booster cases was practically nil. The M. W. Kellogg Company not only refused to commit itself to a firm delivery schedule, but also failed to meet the previously agreed deadline of 27 August for shipment of cases to the Watertown Arsenal for machining operations.[62] Judging from the existing performance rate, the Rocket and Launcher Section concluded that the best delivery schedule obtainable under the short time limits would be five complete units by 30 September, five by 20 October, and the remaining 15 units by 30 November 1951.[63] General Simon's terse response to this set-back, on 29 August, was neither formal nor conciliatory: "This is entirely unsatisfactory. If Rocket Sect. can not obtain earlier

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[61](1) DF, 00 471.94/521, ACofOrd to Chf, BuOrd, DN, 15 Aug 51, sub: Large Cal Fld Rkt - HJ Proj TU2-1029, DA Priority 1A. (2) Memo, ACofOrd for Mr. Pace, SA, 16 Aug 51, sub: The Accelerated HJ Program. Both in ORDTU File, Jun - Aug 51, MRB GSA FRC.

[62]Memo, Chf, ORDTU, to Chf, Ord R&D Div, 27 Aug 51, sub: Expediting of HJ Proj. ORDTU File, Jun - Aug 51, MRB GSA FRC.

[63]Memo to Chf, R&D Div, 24 Aug 51, sub: Status of HJ. ORDTU File, Jun - Aug 51, MRB GSA FRC.

deliveries, I must get somebody else on the job who can. It will not even do for an A-1 priority - much less a 'crash' priority."[64]

(U) Two days later, it became apparent that earlier deliveries could not be achieved, and in fact the schedule would be delayed another 2 weeks. In a conference with Ordnance Corps and Navy representatives at the Bureau of Ordnance, Mr. W. C. King of the M. W. Kellogg Company announced that 14 of the booster cases could be delivered by the middle of November and the remaining 11 units by mid-December. This schedule, he said, was based on "some question as to the [Watertown] Arsenal's ability to perform all the work previously agreed to . . . ." When first approached for a set of detailed drawings and specifications so the Ordnance Corps could line up subcontractors to expedite deliveries, Mr. King refused on the grounds that it "would involve giving competitors . . . Kellogg developed processes and trade secrets."[65]

(U) Capt. F. A. McKee, representing the Bureau of Ordnance, promptly countered with the observation that such a position would be acceptable and understandable in peacetime, but pointed out that this was not a time of peace and that the equipment under discussion was urgently needed to expedite a high priority weapon for "possible use in defense of this country . . . ." Mr. King then offered an alternate solution whereby the Ordnance Corps would refer prospective contractors to Kellogg for direct negotiations. Lt. Col. W. C. Ohl, Honest John Project Officer, OCO, argued that detailed drawings would still be needed to screen the prospects. Mr. King was adamant.[66]

(U) In the heated debate that followed, Captain McKee managed to bring out the root of the Government's problem—not only in the case under discussion, but throughout the industrial structure—with the

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[64]Handwritten Memo to ORDTU, 29 Aug 51, attached to foregoing memo. (At that time, General Simon was serving in the dual capacity of Assistant Chief of Ordnance and Chief of the R&D Division.)

[65]Min of Conf on JATO Cases, BuOrd, 31 Aug 51, pp. 2, 4. ORDTU File, Sep - Nov 51, MRB GSA FRC.

[66]Ibid., p. 4.

loaded question of whether the Kellogg Company was attempting to advance its own business position or the defense production position of the nation. Mr. King "somewhat laughingly" replied, "the Kellogg business position," adding that the Kellogg Company had entered the booster case field 5 years ago when no other companies in similar field were willing to do any Government research and development work. It "was not happy, however, to be in the position of doing all the development work on these items and then having competitors get the production contracts."[67]

(U) This clearly explained the company's motives, but it failed to change the fact that the delivery schedule offered was unacceptable to the Ordnance Corps. Since the Kellogg Company obviously could not meet the required deliveries, it simply would have to turn the work over to Ordnance-approved contractors who could. Mr. King finally agreed to a compromise solution, whereby Colonel Ohl could use detailed drawings for the investigation of subcontractors, but the final responsibility for selection and supervision of contractors would rest solely with the Kellogg Company. It was also agreed that any expediting action on the Honest John program was in no way to interfere with priority guided missile projects: namely, the Terrier and Nike Ajax.[68]

(U) With efforts under way to expedite booster case deliveries and with three loaded boosters already on hand at the proving ground, the Resident Ordnance Officer at the Douglas Aircraft Company, in mid-September, drew up a flight test plan which called for the first firing (Round 6) during the week of 1 October and completion of the tests (through Round 30) by 26 November 1951.[69] At about the same time, project engineers of the Redstone Arsenal and the Aberdeen Proving Ground agreed upon the R&D flight test program required to fully investigate the design characteristics and potentialities of the 1236F rocket. However, the Chief of Ordnance rejected their plan and directed that all

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[67] Ibid., p. 5.

[68] Ibid., p. 7.

[69] Ltr, Maj H. E. Whitmore to CofOrd, 14 Sep 51, sub: HJ Firing Scd. ORDTU File, Sep - Nov 51, MRB GSA FRC.

the rockets be of a "fixed design" as far as aerodynamic considerations were concerned.[70]

(U) Pair Firing

(U) Another decision along this line called for the R&D rockets (beginning with Rounds 6 and 7) to be fired in pairs, as closely together as possible, to verify more accurately the influence of varying atmospheric conditions (winds, temperature, humidity, air pressure, etc.) on rocket dispersion. This decision, and the fact that the Douglas Aircraft Company had not delivered the second R&D fixed-base launcher (originally scheduled for delivery by 20 September), led to a 2-week delay in the flight test plan. The amended schedule, issued by the Chief of Ordnance on 20 September, called for the first two firings the week of 15 October and completion of the tests by mid-December 1951.[71]

(U) Just 48 hours later this schedule, too, was doomed. With only five loaded JATO's delivered to the proving ground, a disastrous fire at the Allegany Ballistics Laboratory destroyed all the propellant molds and brought production to a sudden halt on 22 September. Four of the five rounds available (Rounds 6 through 9) were being conditioned for firing, in pairs, on 17 October and 24 October, respectively; but Round 10 could not be scheduled for flight test until its mate arrived at the proving ground. To complete this third pair, it was necessary to use one of the six propellant charges which had been committed to other missile projects. The firing schedule thus established on 9 October called for the flight test of Rounds 10 and 11 on 31 October; however, since these rounds would be the last ones available until late November and Gen. J. Lawton Collins, then Army Chief of Staff, wanted to see

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[70] Memo, Fred B. Smith, Dep Chf, Rkt Dev Gp, to Dir, OML, 8 Dec 52, sub: Ord Proj TU2-1029 - HJ - Tech Supv. HJ R&D Case Files, Box 14-9, RHA AMSC.

[71] (1) 1st Ind, CofOrd to ROO, DAC, 20 Sep 51, on Ltr, 14 Sep 51, cited footnote 69 above. (2) Ltr, ROO, DAC, to CO, WSPG, 21 Sep 51, sub: HJ Firing Scd. ORDTU File, Sep - Nov 51, MRB GSA FRC. (3) Also see HJ Blue Book, p. 7.

an Honest John firing during a planned visit on 14 November, they were rescheduled for firing on that date.

(U) At the time of the fire, the additional propellant molds—purchased in late August 1951 to increase production capacity—were being machined at the Watertown Arsenal, and therefore would be available to replace those destroyed. But then another problem arose in early October, when the Allegany Ballistics Laboratory discovered that the castings could not be used because of large pores. The laboratory attempted to repair the initial castings by spot soldering and indicated that propellant would be available to resume loading by early November.[72]

(U) The test crew at White Sands completed the first three pairs of firings precisely according to the revised schedule—i.e., 17 October, 24 October, and 14 November, respectively. By the end of November, three more rockets had been delivered, and two of them (Rounds 12 and 13) had been fired. At that time, the Watertown Arsenal had completed all the propellant mold castings, but these had to be impregnated with pore filler material and were not immediately available for production. Meanwhile, the Allegany Ballistics Laboratory continued to load and ship JATO units at the rate of one per week, with the delivery of booster cases by the Kellogg Company continuing at the rate of three per week.[73]

(U) Temperature Conditioning

(U) Another factor contributing to the overall delay in this phase of the R&D test program was the 14-day interim period required to assemble and temperature-condition the rockets after all of the components arrived at the proving ground. Since most of the rockets had to be fired in ballistic pairs, it was essential that each pair undergo identical temperature conditioning, etc. As a result, there was very often

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[72](1) Memo, Chf, ORDTU, to Chf, Ord R&D Div, 1 Oct 51, sub: Status of HJ. (2) Memo, same to same, 9 Oct 51, sub: Status of HJ. Both in ORDTU File, Sep - Nov 51, MRB GSA FRC.

[73]Memo, Chf, ORDTU, to Chf, Ord R&D Div, 30 Nov 51, sub: HJ Proj. ORDTU File, Sep - Nov 51, MRB GSA FRC.

an odd round available which could not be conditioned until its mate arrived. For example, Round 14 arrived at the proving ground in the latter part of November 1951, but its mate did not arrive until early December and the two were not conditioned and ready for firing until 17 December 1951. This situation, together with the time lost as a result of other problems, eventually snowballed into a total program delay of exactly 7 months and 21 days beyond the original target date (30 September 1951), and nearly 6 months beyond the first revised target date (26 November 1951) established on 14 September. (See Table 3.)

(U) The aforementioned delay, coupled with the phase-in of industrial activity some 6 months before completion of developmental tests, generated many technical problems and latent system deficiencies which could not be clearly defined and solved until after the initial engineering-user tests in 1953. The Redstone project engineers released component design changes to production as soon as development and ballistic firings were completed, late in 1952. But the technical suitability of the overall weapon could not be definitely established until sufficient proof tests had been conducted. To compound the problem further, firm military characteristics were not received until nearly half of the developmental tests had been completed, and the number of R&D rounds allotted to the program was patently inadequate to evaluate properly the technical suitability of the weapon.[74] It is the development of the M31 rocket design in the face of these problems to which this study now turns.

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[74] Memo, Fred B. Smith, Dep Chf, Rkt Dev Gp, to Dir, OML, 8 Dec 52, sub: Ord Proj TU2-1029 - HJ - Tech Supv. HJ R&D Case Files, Box 14-9, RHA AMSC.

Table 3—(U) Revised Firing Schedule vs Accomplishment
(R&D Rounds 6 through 30)

Round Number	Week to be Fired (Scd: 14 Sep 51)	Date Fired
6	1 - 7 Oct 51	17 Oct 51
7	8 - 14 Oct 51	17 Oct 51
8	8 - 14 Oct 51	24 Oct 51
9	15 - 21 Oct 51	24 Oct 51
10	15 - 21 Oct 51	14 Nov 51
11	22 - 28 Oct 51	14 Nov 51
12, 13	22 - 28 Oct 51	28 Nov 51
14	22 - 28 Oct 51	17 Dec 51
15	29 Oct - 4 Nov 51	17 Dec 51
16, 17	29 Oct - 4 Nov 51	4 Jan 52
18	29 Oct - 4 Nov 51	9 Jan 52
19	5 - 11 Nov 51	9 Jan 52
20, 21	5 - 11 Nov 51	11 Feb 52
22	5 - 11 Nov 51	11 Feb 52
23	12 - 18 Nov 51	11 Feb 52
24, 25	12 - 18 Nov 51	27 Feb 52
26	12 - 18 Nov 51	31 Mar 52
27	19 - 26 Nov 51	31 Mar 52
28, 29	19 - 26 Nov 51	10 Apr 52
30	19 - 26 Nov 51	21 May 52

SOURCE: (1) Ltr, ROO, DAC, to CofOrd, 14 Sep 51, sub: HJ Firing Scd. ORDTU File, Sep - Nov 51, MRB GSA FRC. (2) HJ Data Summary Chart (OV Grain), DAC, 18 Feb 53. HJ R&D Case Files, Box 14-9, RHA AMSC.

CHAPTER IV

(U) EVOLUTION OF THE M31 ROCKET DESIGN (U)

(U) The first operational model of the M31 series Honest John rocket evolved from a two-part development and test program which began in August 1951 and ended with the release of drawings for volume procurement in the early fall of 1953. The first phase of the program embraced a series of developmental tests to determine whether or not the 1236F rocket with a reduced spin rate could meet the established accuracy requirements. Phase II consisted of continuing design refinement and flight tests to correct deficiencies noted in Phase I tests and to improve overall performance. Flight tests of the Type II R&D tactical prototype began in November 1952 and the drawings were released for industrial procurement in September 1953.

(U) Development and Evaluation of the Slow-Spin Concept (U)

(U) The rockets built and flight tested in the initial phase of the crash development program (Rounds 6 through 30) were essentially of the same aerodynamic design as the five demonstration models fired in mid-1951. The latter rounds had been spin-stabilized at a nominal rate of 5 revolutions per second (rps), and most of them had fallen well within the required accuracy limits. However, the axial and centrifugal acceleration forces in a missile spinning at the rate of 5 rps would preclude the use of the TX-7 atomic head. Since one of the primary missions of the Honest John was to serve as a direct-support atomic weapon, the marriage of the TX-7 warhead to the 1236F rocket was of paramount importance. Information supplied by the Sandia Corporation, in mid-August 1951, indicated that a spin rate of 2 rps was the maximum that could be safely imposed on the TX-7 head. Ballistic data gleaned from the initial firings at 5 rps indicated that accuracy requirements could be met with the slow-spin rocket. But the only way to prove it beyond doubt was through actual flight tests.[1]

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[1] Memo, ORDTB-AB to Chf, Ord R&D Div, 16 Aug 51, sub: Trip Rept of Capt Albert Clark to Sandia Corp. ORDTU File, Jun - Aug 51, MRB GSA FRC.

(U) Hence, the foremost objective of the 25-round test program was to determine whether or not the 1236F rocket with reduced spin rate could meet the established accuracy requirements. Although the components used in these units were basically the same as those previously described for the first five rounds,[2] the physical characteristics were necessarily changed in several respects to obtain the desired data for an adequate appraisal of slow-spin performance. Among the most important physical changes was a decrease in the fin cant from 1.5° to 0.5° to reduce the spin rate. To provide a basis for comparative evaluation, the rockets were fired under several combinations of conditions. For example, Rounds 6 and 7 were designed for a "no spin" condition, and the next two for a "reverse spin."[3] Other units were fired under various atmospheric conditions (e.g., low, medium, and high winds) and at different launch angles or quadrant elevations ranging from 22-1/2° to 50°.[4]

(U) Other significant changes in physical characteristics centered around the nose section. All of the rounds fired through December 1951 (Rounds 6 through 15) carried 1,500-pound steel ballasts or dummy warheads without telemetry. Beginning with Round 16, fired early in January 1952, the Douglas Aircraft Company replaced the steel ballast with one made of concrete because of the lower cost involved and the fact that it more closely simulated the weight distribution of the proposed warheads which

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[2] See above pp. 38 - 40.

[3] "No spin" indicates a design in which the fins are given a small angle of attack (about 0.5°) with an alignment error of plus or minus (±) 0.25; no spin rockets are used. "Reverse spin" indicates a condition in which all eight spin rockets are used and ignited when the missile leaves the launcher. The angle of attack of the fins is set to give an opposite direction of rotation to the missile, compared to that imparted by the spin rockets. The missile will then reverse its direction of rotation during the burning period and continue to rotate at a very slow rate. Min of Conf on HJ Proj TU2-1029, Ballistic Research Laboratories, Aberdeen Proving Ground (BRL, APG), 30 - 31 Aug 51. HJ R&D Case Files, Box 14-9, RHA AMSC.

[4] (1) Ibid. (2) HJ Data Summary Chart (OV Grain), DAC, 18 Feb 53. HJ R&D Case Files, Box 14-9, RHA AMSC.

were then in the early stages of development. Most of the latter rounds also carried telemetering instruments, and two of them (Rounds 16 and 18) were equipped with a special concrete ballast weighing about 1,136 pounds to simulate the XW-7 warhead.[5]

(U) All except the last round in this series were fired from the fixed-base R&D launchers which provided 30 feet of guidance. Beginning with Round 30 and continuing through the next several firings, the Douglas Aircraft Company used a reduced 25-foot guidance length to evaluate the effect on rocket dispersion.[6]

(U) When the experimental nature of these early rounds and the continuing lack of time for adequate bench tests of components are considered, the results achieved were most remarkable. All but four of the rockets were successfully launched and impacted in the general area predicted, thus demonstrating the feasibility of the slow-spin concept. Rounds 9 and 18 experienced nose failures and both impacted some 12,700 yards from the launch site—about half way to the predicted point. Rounds 10 and 27 had excessive deflection errors because of spin rocket trouble; however, motor performance was good and the rockets impacted at an actual range of 21,228 yards and 21,703 yards, respectively.[7] The deflection errors of some other rounds were also excessive, but perfect performance could hardly be expected of these rough, experimental models. With further development and refinement of major components, Honest John performance would show definite signs of improvement.

(U) Component Development and Evaluation (U)

(U) Phase II of the development program consisted of continuing

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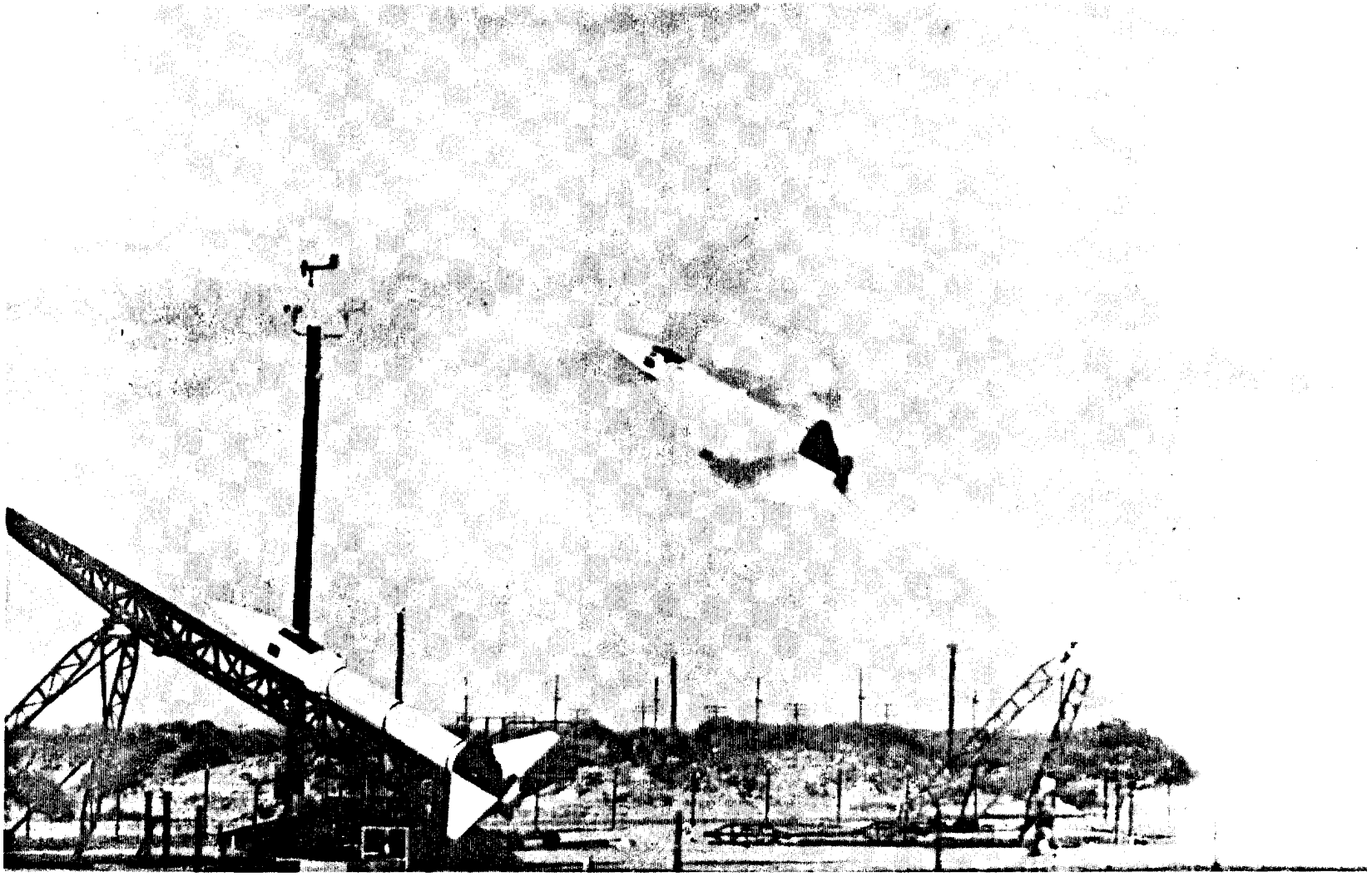
[5](1) Ibid. (2) HJ Blue Book, p. 7.

[6]HJ Data Sum Chart (OV Grain), DAC, 18 Feb 53. HJ R&D Case Files, Box 14-9, RHA AMSC. (As will be noted in Chapter VIII, two attempts were made to develop a launcher with reduced guidance length for the Basic Honest John System; however, this type launcher was not successfully developed and adopted until after the improvement program began in 1955.)

[7]Ibid.



Flight Test of Experimental Honest John Rockets at the White Sands Proving Ground in New Mexico, 1951 - 52 (Exact Time Unknown; WSPG Photo.)

design refinement and flight tests of components for the tactical M31 rocket. During the period May 1952 through early November 1952, the test crew at the White Sands Proving Ground fired 33 Type I rockets to evaluate several major components which had been modified to correct certain deficiencies noted in Phase I tests and to improve overall performance. Early in this period, the Douglas Aircraft Company completed the preliminary drawings for the Type II rocket, the principal changes from the Type I design including a pedestal for warhead mounting and a hinged-nose fixture to accommodate warhead installation (see illustrations). Flight test of Type II R&D tactical prototype rockets began with the firing of Round 64 on 17 November 1952. From this point on, the Phase II R&D test program embraced rockets of both the Type I and II design, the latter naturally predominating. With the firing of Round 70, on 26 November 1952, the Douglas Aircraft Company turned the assembly and test operations over to the Ordnance Corps crew but continued to furnish engineering liaison.[8]

(U) Because of the tight deadlines imposed by the crash-type schedule, the second and succeeding phases of the Honest John development program necessarily overlapped each other. For example, Phase II R&D firings began in mid-1952 and continued through 1955, while Phase III engineering-user evaluation firings began in January 1953 and continued into 1956. In like manner, Phase IV industrial firings—acceptance tests of factory-produced Type III rounds—started on 10 September 1953 and continued several years beyond the conclusion of Phase III.[9]

(U) From these overlapping programs emerged four tactical models of the Basic Honest John Rocket: (1) the M31, classified as substitute

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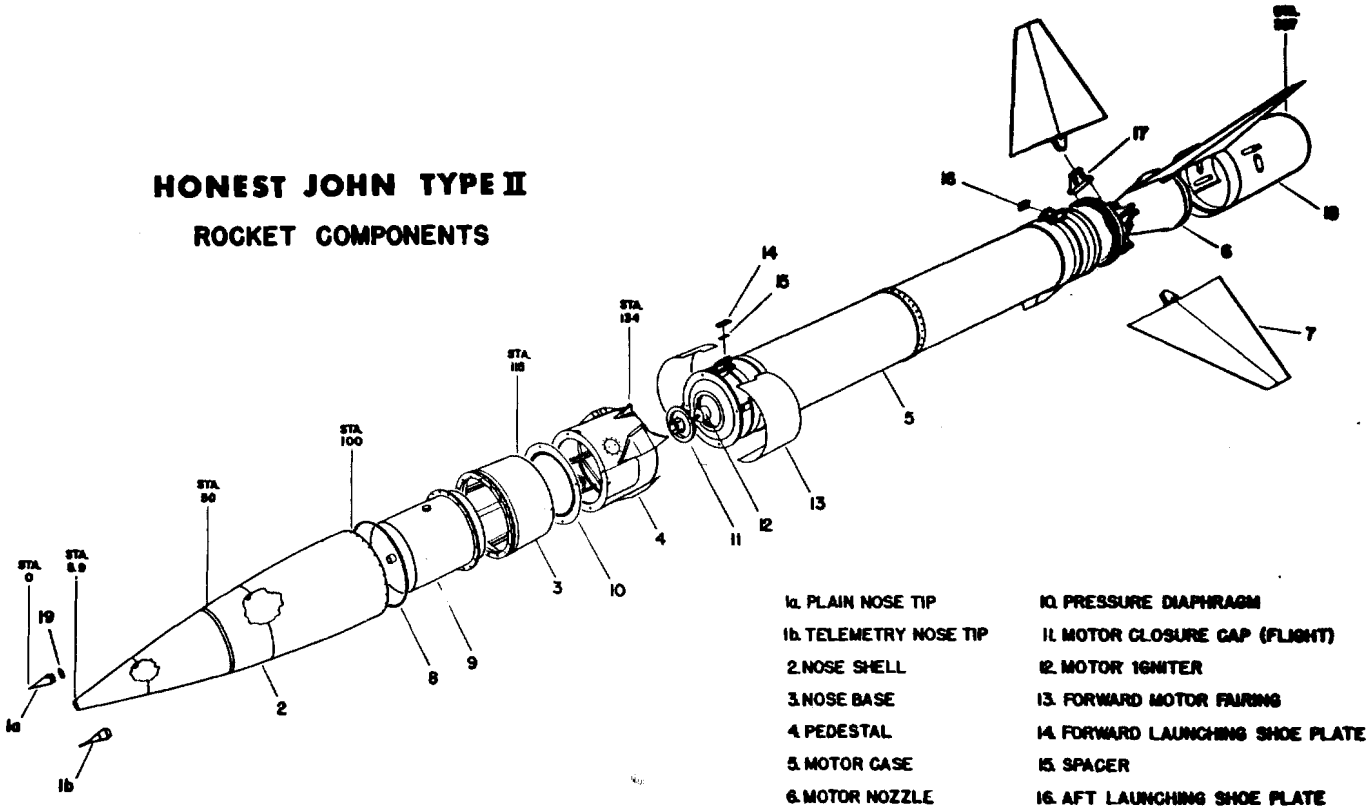
[8](1) Ltr, CO, RSA, to CofOrd, 16 May 52, sub: Ord Proj TU2-1029 - DA Pri 1A - Scheduling. ORDTU File, May 52, MRB GSA FRC. (2) HJ Blue Book, p. 12. (3) Ltr, DAC to Chf, LAOD, 3 Dec 52, sub: Prog Rept No. 24, Model 1236F HJ. HJ R&D Case Files, Box 14-9, RHA AMSC. (4) DAC Rept SM-18650, 11 May 55, sub: Final Flight Test Report for Honest John Rounds 1 through 193, pp. 8 - 9. RSIC.

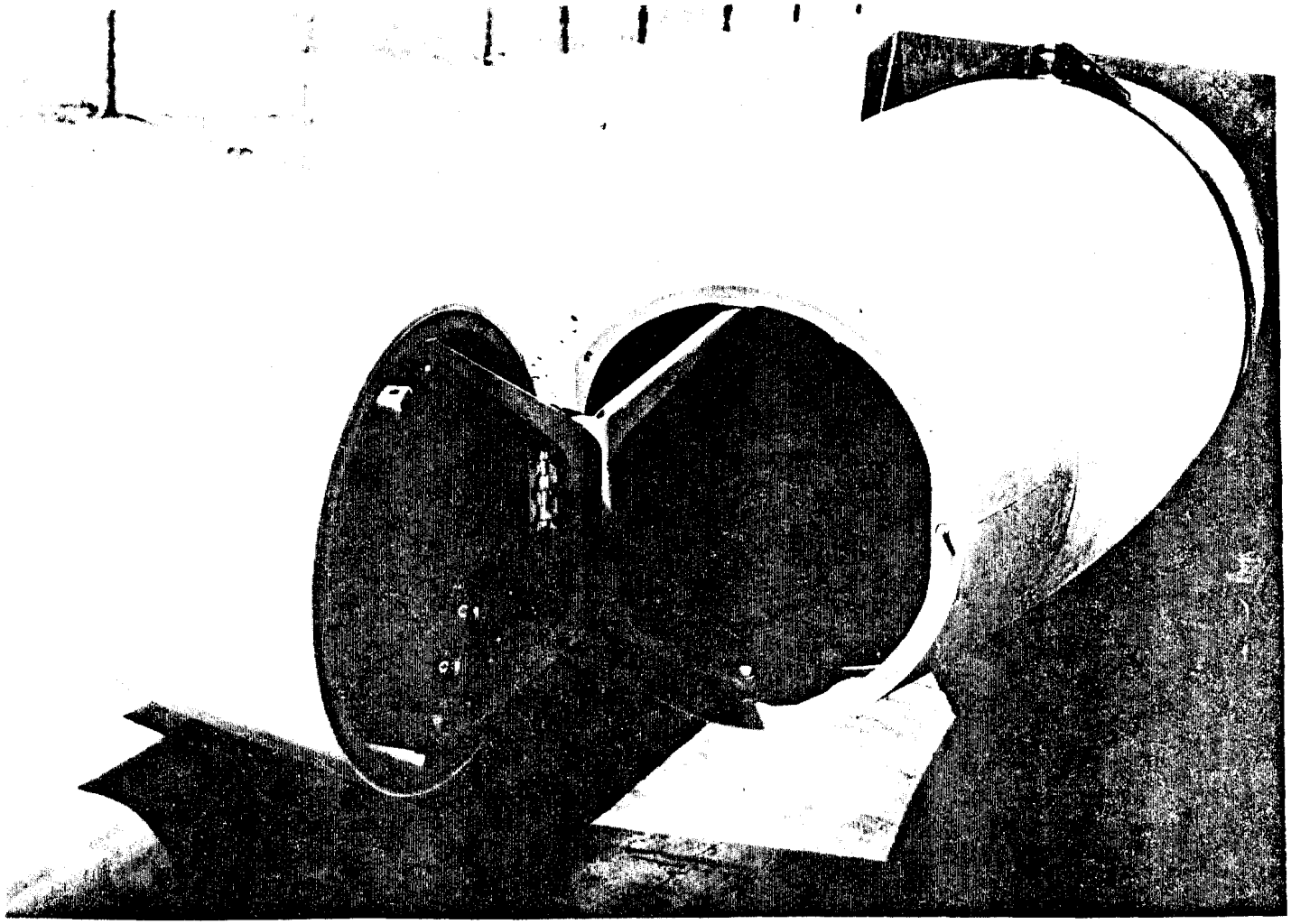
[9](1) Ibid. (2) Eunice H. Brown, et al., "Development & Testing of Rockets & Missiles at White Sands Proving Ground, 1945 - 1955," (WSMR, 1 Oct 59), pp. 166 - 67.

HONEST JOHN TYPE II
ROCKET COMPONENTS



1a. PLAIN NOSE TIP	10. PRESSURE DIAPHRAGM
1b. TELEMETRY NOSE TIP	11. MOTOR CLOSURE CAP (FLIGHT)
2. NOSE SHELL	12. MOTOR IGNITER
3. NOSE BASE	13. FORWARD MOTOR FAIRING
4. PEDESTAL	14. FORWARD LAUNCHING SHOE PLATE
5. MOTOR CASE	15. SPACER
6. MOTOR NOZZLE	16. AFT LAUNCHING SHOE PLATE
7. FIN	17. FIN ATTACH FITTING
8. SEAL	18. NOZZLE – FIN FAIRING
9. BALLAST	19. "O" RING

Exploded View



Hinged Nose Section (Open) Showing Concrete Ballast Installed

standard in September 1953 and deployed in the spring of 1954; (2) the M31A1, standardized in September 1954; (3) the M31A1C, standardized in October 1956; and the final M31A2 model, initially produced and delivered in June 1959 to supplement the M31A1C as Standard A type. The present discussion is limited to the development and evaluation of components for the initial M31 model. The succeeding models are treated in the chapter dealing with the Product Improvement and Industrial Programs.

(U) Motor Development (U)

(U) During the preliminary design studies, the engineers at the Redstone Arsenal had recognized that the Navy-developed JATO unit selected for the Honest John research vehicle would not be satisfactory for service use because of the firing temperature limits of its OV-type propellant.[10] However, to meet the crash schedule for early delivery of an operational system, the Chief of Ordnance decided, in the late fall of 1951, that the X202C6 JATO unit would have to be used in the interim system despite its attendant disadvantages. This presented an immediate problem, in that the motor had been developed strictly for experimental purposes and therefore had never been evaluated in the extensive manner necessary for field application. The Bureau of Ordnance reported, in November 1951, that the JATO unit had been used in some 20 successful flight tests, all under controlled flight conditions within the established temperature limits. The ballistic data obtained from these tests and from earlier static tests indicated that the firing temperature limits could not be safely extended beyond +40°F. to +100°F.[11]

(U) Early in 1952, the Chief of Ordnance directed the Picatinny Arsenal to undertake a development program to extend the operational temperature limits of the Honest John rocket, using a less temperature-sensitive propellant but retaining the same metal parts design and interior ballistics as the existing X202C6 unit. The latter restriction

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[10] See above pp. 22 - 23.

[11] Ltr, Chf, BuOrd, DN, to CofOrd, 17 Nov 51, sub: JATO 4-DS-105,000 X202C6, HJ, Limitations on. ORDTU File, Sep - Nov 51, MRB GSA FRC.

was essential because ballistic tests of the unit had reached the point where a change in performance characteristics would seriously affect the progress of development.[12] At the same time, the Redstone Arsenal undertook a program to establish the service temperature limits of the existing JATO unit using OV-type propellant, since it did not appear that an improved propellant could be developed in time for initial field issue.[13]

(U) These propellant programs had hardly started when further information from the Allegany Ballistics Laboratory prompted a change in plans. As a result of additional experiments with the X202C6 JATO, the Laboratory found it necessary to reduce the firing temperature limits from the former values of +40°F. to +100°F., to +50°F. to +90°F. Furthermore, it "strongly recommended that until more experience is obtained with this JATO to adequately judge the variations in ballistic performance all units be conditioned at 70°F. to 80°F. for four days prior to firing."[14] Realizing that the OV-type propellant with its reduced temperature range would be unacceptable even for interim field use, the Chief of Ordnance immediately established a new program at the Allegany Ballistics Laboratory with the object of adapting the OIO-type propellant to the X202C6 JATO design. To provide motors for static and dynamic tests, he authorized the Laboratory to cast an initial lot of 10 OIO-type grains, using the same molds and therefore retaining the configuration previously cast in OV propellant.[15]

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[12] Ltr, 00 471.94/929, CofOrd to CO, PA, 18 Jan 52, sub: Proj TU2-1029 HJ, DA Pri 1A. HJ R&D Case Files, Box 14-9, RHA AMSC.

[13] Ltr, 00 471.9/1372, CofOrd to CO, RSA, 14 Feb 52, sub: Proj TU2-1029, HJ, DA Pri 1A. HJ R&D Case Files, Box 14-9, RHA AMSC.

[14] Ltr, Pdn Supv, ABL, to Chf, BuOrd, DN, 11 Mar 52, sub: Rev Firing Temp Limits for the JATO, 4-DS-105,000, X202. (2) Also see Ltr, Ch, BuOrd, to CofOrd, 28 Mar 52, same sub. Both in ORDTU File, Mar - Apr 52, MRB GSA FRC.

[15] Ltr, 00 471.9/1714, CofOrd to Chf, BuOrd, DN, 3 Apr 52, sub: HJ Propellant - OIO Dev, Proj TU2-1029, DA Pri 1A. ORDTU File, Mar - Apr 52, MRB GSA FRC.

(U) While the OIO propellant grain had a wider operational temperature range than the OV composition, it also had a somewhat lower specific impulse and therefore would have some detrimental effect on the range capability of the Honest John. However, because of the urgency of the program, the Chief of Ordnance decided to accept some compromise in ballistic performance and proceed with the manufacture of test JATO's using the OIO composition. The propellant program at the Redstone Arsenal was thus reoriented to provide for cycling tests of the new JATO unit; while the Picatinny Arsenal initiated photoelastic studies, in conjunction with the Armour Research Foundation, to determine the stress characteristics of OIO-type grain designs.[16]

(U) By 17 June 1952, the Allegany Ballistics Laboratory had statically fired six of the 10 OIO propellant charges in the X202C6 chamber—three at +40°F. and three at +110°F. Later that month, the remaining four OIO charges were successfully flight tested in ballistic pairs (Rounds 35-36 and 37-38) at the White Sands Proving Ground. The results of the static firings confirmed that the substitution of OIO propellant had lowered the total impulse of the unit; however, the Allegany Ballistics Laboratory indicated that the variation of impulse and thrust with temperature and from round-to-round should be greatly improved. These findings were further confirmed by the flight tests results.[17]

(U) The JATO unit used in Round 39, fired early in July 1952, was the last to be loaded with OV-type propellant. Subsequent Honest John rounds, both flight and static, used the new motor loaded with OIO

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[16](1) Ltr, 00 471.9/1689, CofOrd to CO, RSA, 2 Apr 52, sub: HJ Propellant, Proj TU2-1029; 1st Ind thereto, CO, RSA, to CofOrd, 28 Apr 52. (2) Ltr, CO, RSA, to CofOrd, 10 May 52, sub: Ord Proj No. TU2-1029, HJ, OIO Propellant Grains. (3) 2d Ind, CofOrd to CO, PA, 11 Apr 52, on Ltr, 00 471.94/929, cited footnote 12 above. All in ORDTU File, Mar - Apr 52, MRB GSA FRC.

[17](1) Ltr, ABL to Chf, BuOrd, DN, 17 Jun 52, w/Incl, "Static Firing Data Summary." ORDTU File, Jun 52, MRB GSA FRC. (2) HJ Data Sum Chart (OIO Grain), DAC, Rev 26 Feb 53. HJ R&D Case Files, Box 14-9, RHA AMSC.

propellant and designated as the 4-DS-105,000 X202E1.[18]

(U) Redesign of the Spin Rocket Ignition System (U)

(U) The trouble experienced with the spin rocket, as with other Honest John components, stemmed mainly from the lack of time to conduct adequate functional tests before proceeding with full-scale flight tests. Like the main power plant, the spin rocket was an off-the-shelf item, having been developed by the Jet Propulsion Laboratory for use in an early research vehicle. The Redstone Division of the Thiokol Corporation designed the modified spin rocket early in 1951, the most significant change involving the use of Thiokol T10E1 propellant—an internal-burning, 6-pointed star grain—instead of the JPL-117D propellant. The Douglas Aircraft Company furnished the metal parts; the Thiokol Corporation loaded the motors and furnished the igniters. Of the 56 spin rockets initially produced, 40 were expended in the five demonstration firings, leaving only two sets for laboratory functional tests. The accelerated test schedule of August 1951 left no time for further functional tests. But with the failure of spin rocket ignition on Round 10, fired in mid-November, the Resident Ordnance Officer at the Douglas Aircraft Company insisted that additional bench tests were essential to improve reliability.[19]

(U) By mid-March 1952, the basic design characteristics of the Honest John spin rocket had been established and the assembly had been officially designated as JATO, 0.4-KS-640, T53.[20] The first major redesign effort began some 2 weeks later, following the ignition failure on Honest John Round 27. In addition to the ignition deficiency,

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[18](1) Ibid. (2) HJ Data Sum Chart (OV Grain), DAC, 18 Feb 53. HJ R&D Case Files, Box 14-9, RHA AMSC. (3) 2d Ind, CG, RSA, to CO, PA, 18 Jul 52, on Ltr, same to same, sub: Ord Proj No. TU2-1029, HJ, DA Pri 1A; Temp Cycling Tests. ORDTU File, Jul - Aug 52, MRB GSA FRC.

[19]Memo, ROO, DAC, to Dir of Projs, RSA, 11 Dec 51, sub: Tests on Spin Rkts, HJ. HJ R&D Case Files, Box 14-9, RHA AMSC.

[20]Ltr, CO, RSA, to CofOrd, 6 Mar 52, sub: Ord Proj No. TU2-1029, HJ, DA Pri 1A, Spin Rkts; 1st Ind, CofOrd to CO, RSA, 14 Mar 52. HJ R&D Case Files, Box 14-9, RHA AMSC.

the nozzle and igniter assembly was found to be highly susceptible to damage, some assemblies having arrived at the proving ground in such poor condition that they had to be replaced.

(U) Tests of the various sizes and types of igniters led to the selection of a damage-resistant "Jelly Roll"-type igniter with improved ignition characteristics. Like the original model, it was about 4 inches long and less than an inch in diameter. Its component parts, from outside to center, consisted of an aluminum tape cover; a cotton broadcloth base sheet; 6 grams of X-179 igniter composition (66% Magnesium Powder; 28% Potassium Perchlorate; and 6% "Vistanex" Binder); and a Dupont S-67 Squib with a reduced rubber base. The Thiokol Corporation completed the drawings of the improved igniter in June 1952 and delivered the initial units to the proving ground in July.[21] The new igniter appeared to improve the ignition reliability of the T53 JATO; however, a recurrence of spin rocket failures in the fall of 1952 led to further design changes which will be discussed later.

(U) Fuze and Warhead Development (U)

(U) The fuzing system for most of the Type I R&D rounds consisted of the T1 arming accelerometer (a modified version of the Nike FF-4106 arming mechanism) and the T2 100-second timer fuze, both furnished by the Frankford Arsenal. Serious malfunctions had occurred in the fuzing system during the demonstration firings; but this had no significant effect on the basic program objectives, since all of the rounds impacted in the general area predicted and proved the feasibility of the system. However, the lack of a reliable arming and fuzing system for the Honest John soon became a matter of extreme concern.

(U) As early as mid-August 1951, both Mr. Stocking of the Douglas Aircraft Company, and Mr. L. A. Hopkins of the Sandia Corporation, emphasized that the timers furnished by the Ordnance Corps for use in

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[21] Ltr, Rst Div, Thiokol Corp., to CG, RSA, 22 Jul 52; and Incl 1 thereto, Drawings No. CR-304, "Igniter for JATO, 0.4-KS-640, T53," 26 Jun 52. HJ R&D Case Files, Box 14-9, RHA AMSC.

the Honest John were completely inadequate. They pointed out, for example, that only one of the timers had functioned properly; that an examination of some of the other timers had revealed metal chips and shavings in the clock mechanism; and, further, that one of the timers had been received in a "tripped" position and could not be used. A high degree of arming system reliability would be absolutely essential for all types of warheads, but particularly so for the nuclear head.[22]

(U) While everyone seemed to agree that the Frankford Arsenal fuzing system was patently inadequate, no one could offer a specific solution to the problem for the simple reason that the exact types of warheads and technical requirements therefor were yet to be defined. Major H. E. Whitmore, Resident Ordnance Officer at Douglas Aircraft, reported: "At the present time [22 August 1951] it is very difficult for Douglas, or this office, to make recommendations on the presently used arming and fuzing system . . . since it is not known for which warhead, or warheads, this fuzing is intended. . . ."[23] Tentative plans at that time called for priority development of a nuclear head and several different types of interchangeable, conventional heads; however, definite plans and schedules hinged largely on the outcome of the 25-round accelerated test program and the establishment of firm warhead requirements by the Army Field Forces. Meantime, the Ordnance Corps continued to use the Frankford Arsenal fuzing system as an interim, stop-gap measure and proceeded with preliminary engineering design work on some basic types of conventional warheads.

(U) Early in November 1951, shortly after resumption of R&D flight tests, the Picatinny Arsenal, assisted by the Ballistic Research Laboratories at Aberdeen Proving Ground, started an engineering study on two types of conventional warheads for the Honest John rocket. One was a blast-type, high explosive head, designated as the T2021; the

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[22] Memo, ORDTB-AB to Chf, Ord R&D Div, 16 Aug 51, sub: Trip Rept of Capt Albert Clark to Sandia Corp. ORDTU File, Jun - Aug 51, MRB GSA FRC.

[23] Ltr to CO, RSA, sub: Arming & Fuzing for the HJ Msl. ORDTU File, Jun - Aug 51, MRB GSA FRC.

other was a fragmentation-type head, for use in an anti-personnel role. The tentative plan called for the engineering design of the most effective blast and anti-personnel warheads of conventional type that could be made available by April 1952.[24]

(U) The Ballistic Research Laboratories began development of the anti-personnel warhead in March 1952, while the Picatinny Arsenal concentrated on the design and development of the T2021 blast-type, high explosive head. The plan, as of late March 1952, called for a minimum of five T2021 units, equipped with the interim T1402 fuzing system, to be available for flight testing in August 1952, these units to be adaptable for quantity production pending the availability of T2021E1 heads with optimum fuzing in December 1952.[25]

(U) The T1402 fuze was not considered suitable for the T2021 warhead because there was a chance that it might be inoperative at some expected impact angles. Moreover, the use of uninterrupted primacord in any fuze system was regarded as a potential safety hazard, especially in this particular application. The fuzing system thus recommended for the T2021E1 head consisted of the T1400 fuze which was to be used in conjunction with the M166E1 VT bomb fuze. The T1400 fuze, a standard item, required a signal in firing to accomplish arming, and it could be adopted with little modification for use with the M166E1 "lucky" transducer in combination with the T1 arming accelerometer and primacord.[26] Early in May 1952, the Chief of Ordnance requested the National Bureau of Standards to develop a version of the M166E1 fuze for use with the T2021 warhead, the project to include preparation of an engineering

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[24](1) Ltr, 00 471.94/715, CofOrd to CO, PA, 29 Oct 51, sub: Whds for Large Cal Fld Rkt, HJ, Proj TU2-1029. (2) 2d Ind, CofOrd to CG, APG, 10 Dec 51, on Ltr, 00 471.94/739, same to same, 5 Nov 51, sub: Whds for HJ Rkt (TB 3-0240D). Both in HJ R&D Case Files, Box 14-9, RHA AMSC.

[25]2d Ind, CofOrd to CO, PA, 24 Mar 52, on Ltr, 00 471.94/715, same to same, 29 Oct 51, sub: Whds for Large Cal Fld Rkt, HJ, Proj TU2-1029. HJ R&D Case Files, Box 14-9, RHA AMSC.

[26](1) Ibid. (2) Memo, Chf, ORDTA, to Chf, ORDTU, 19 May 52, sub: Fuzing for HE Head T2021 Based upon HJ. ORDTU File, Mar - Apr 52, MRB GSA FRC.

release and supply of models for field tests. The Corona Laboratories, Corona, California, developed the fuze under contract with the National Bureau of Standards.[27]

(U) Meanwhile, at the direction of the Chief of Ordnance, the Redstone Arsenal discontinued use of the 100-second Frankford Arsenal timer because of the high failure rate, and procured the Picatinny Arsenal M152 timer as an interim replacement, in late April. The M152 timer was substituted for the Frankford Arsenal model in Round 30, fired on 21 May 1952.[28]

(U) By the end of May 1952, fuzing requirements had been established for the XW-7 warhead, and work on development of the improved T1E1 arming accelerometer was in progress at the Frankford Arsenal. At that time, the Ordnance Corps still felt that the reliability and accuracy of the T2 timer could be improved sufficiently to overcome existing deficiencies, and therefore did not initiate development of an improved model.[29] A few weeks later, however, an urgent need arose for a two-channel timer, and the Frankford Arsenal began development of the T3 fuze as a part of Project TA1-2705.[30]

(U) The Sandia Corporation planned to begin tests of the XW-7 warhead installation in Type II missiles during the first week of October 1952. The Ordnance Corps ordered 40 Model 1236F rockets for this purpose, in June 1952. Ten of these were later modified by Douglas Aircraft and used as research vehicles to provide an overtest of XW-7

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[27](1) Ltr, 00 471.82/1211, CofOrd to Dir, NBS, 7 May 52. ORDTU File, May 52, MRB GSA FRC. (2) Ltr, 00 471.9/2721, CofOrd to Assoc Dir, Ord Dev, NBS, 14 Aug 52. ORDTU File, Jul - Aug 52, MRB GSA FRC.

[28](1) TT ORD-14046, CofOrd to CO, RSA, 23 Apr 52. ORDTU File, Mar-Apr 52, MRB GSA FRC. (2) HJ Data Summary Chart (OV Grain), DAC, 18 Feb 53. HJ R&D Case Files, Box 14-9, RHA AMSC.

[29]2d Ind, CofOrd to CO, FA, 23 May 52, on Ltr, 00 471.9/884, same to same, sub: HJ, TA1-2705 (TU2-1029), Fuze Rqrmt for. ORDTU File, May 52, MRB GSA FRC.

[30]Ltr, 00 471.82/1355, CofOrd to CO, FA, 17 Jun 52, sub: Timer, Fuze, T3 (Proj TA1-2705), Initiation of Dev. ORDTU File, Jun 52, MRB GSA FRC.

warhead components.[31] Over-acceleration test of the warhead was necessary to prove that certain components could function properly during the acceleration phase of flight.[32]

(U) By the time the detailed military characteristics for the Honest John rocket became available in April 1952, the Ballistic Research Laboratories had completed effectiveness studies on six different types of conventional warheads. Among the types considered were the High Explosive (HE) Fragmentation (three types), the HE Fragmentation Cluster, the HE General-Purpose, the Chemical Cluster, the Napalm, and the Incendiary Cluster. The Chief of Ordnance sent the results of the studies to the Army Field Forces, in mid-May 1952, together with a request for information as to the specific types of warheads desired for more detailed study and possible development.[33] Shortly after receipt of the warhead study report, the Army Field Forces established a requirement for an interchangeable practice warhead, the basis of issue to be one inert head for each rocket issued for service practice.[34] (Their failure to provide definite military characteristics for the practice head within a reasonable time later caused much confusion in the procurement program.)

(U) After a review of the effectiveness studies, the Field Forces recommended, in September 1952, that more detailed studies be made on four of the six types of conventional warheads: namely, the HE Fragmentation; Chemical Cluster; Napalm; and Incendiary Cluster. In late October 1952, the General Staff directed the Chief of Ordnance to carry out the proposed studies on an "expedited" basis and be prepared to present "detailed information" on the HE Fragmentation Warhead no later

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[31] See below, pp. 98 - 100.

[32] (1) Ltr, 00 471.9/2082, CofOrd to CO, RSA, 16 May 52, sub: HJ Rkt Dlvry. ORDTU File, May 52, MRB GSA FRC. (2) HJ Blue Book, p. 8.

[33] Ltr, 00 471.9/2113, CofOrd to CCAFF, 15 May 52, sub: Whds for HJ Rkt. ORDTU File, May 52, MRB GSA FRC.

[34] DF, G4/F4-43558, ACofS, G-4, to CofOrd, 9 Jul 52, sub: Est Rqrmts for Specialized Trng & Equip for Dlvry & Spt Units. ORDTU File, Jul - Aug 52, MRB GSA FRC.

than 10 November 1952.[35]

(U) Here is an excellent example of the conflicting sense of urgency that existed at top decision-making levels. The decision handed down by the General Staff had been in process for more than 5 months and obviously had been reached without the slightest sense of urgency. But once passed to the lower operating levels, it suddenly became a matter of great urgency and tight deadlines. This situation, coupled with certain technical problems and the continuing lack of timely guidance from the user, caused a delay in the program schedule and an acceptable conventional warhead still was not available when the initial Honest John batteries reached the field in 1954.

(U) Early in 1953, the tentative warhead requirements for the Honest John were substantially reduced, all but three of the conventional warheads being dropped from active consideration. Aside from the atomic warhead, the first production deliveries of which were expected in September 1953, the Field Forces' requirements consisted of a fragmentation-type warhead, the chemical warhead, the interim T2021 HE Blast warhead, and the inert (concrete ballast) practice head. At that time, the fragmentation and chemical warheads were just entering the field test phase, and it was evident that they would not be available for procurement under the FY-1953 budget. To provide a supply of conventional warheads for the M31 rocket by the end of calendar year 1953, the Chief of Ordnance proposed that a quantity of the blast and practice warheads be procured for interim tactical use. The results of some 15 dynamic and static tests had established the T2021 Blast Warhead as an interim item with marginal performance; but it was the only conventional type that could be made available to the troops, other than the inert

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[35](1) Ltr, ATDEV-10 471.94, OCAFF to ACofS, G-3, 5 Sep 52, sub: Whds for HJ Rkt. (2) Cmt 2, G4/F4-61706, ACofS, G-4, to CofOrd, 22 Oct 52, on DF, G-3 to G-4, 30 Sep 52, sub: same. Both in ORDTU File, Sep - Oct 52, MRB GSA FRC.

practice warhead.[36]

(U) On 5 June 1953, the ACofS, G-4, authorized the Chief of Ordnance to proceed with the procurement of (1) 173 T2021 Blast Warheads with the T1400 Contact and T2039 Low-Burst VT Fuzes, and (2) 170 concrete ballast warheads with spotting charge and T1400/T2039 fuzing systems.[37] The Redstone and Picatinny Arsenals began work on the final Ordnance drawings and specifications for procurement of these items in late June 1953; however, a series of untoward developments kept the program in a state of flux for the better part of the next 12 months.[38] One of the main problems stemmed from the continuing lack of detailed military characteristics for the practice warhead. Other difficulties and delays resulted from constant changes in procurement directives and from technical problems encountered in warhead and fuze development.

(U) In late August 1953, the Chief of Ordnance received a directive from the General Staff which outlined Field Forces' requirements for both a "live" practice warhead and a dummy or drill warhead, but in very loose terms. This practice warhead, the Staff directed, "may be either a HE Blast, HE Fragmentation or a specially designed warhead such as an inert loaded case which gives an indication of burst. . . . There is also a requirement for a dummy or drill head." The directive further stated that the "Honest John and Corporal Warheads should be interchangeable to a maximum degree consistent with missile design." In addition to the interim warheads already authorized for procurement, it also listed the following "optimum requirements" for Honest John warheads: Atomic Head, GB (Gas Bacteriological) Chemical Head,

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[36](1) HJ Blue Book, pp. 67 - 68. (2) MFR, Capt R.W. Fleagle, ORDIM, 27 Jan 53, sub: HJ Whd Rqrmts. ORDTU File, Jan - Feb 53, MRB GSA FRC. (3) DF, CofOrd to ACofS, G-4, 14 Apr 53, sub: Percentage by Type Whd & Fuze Rqrmts for HJ Rkt. ORDTU File, Mar - Apr 53, MRB GSA FRC.

[37]DF, to CofOrd, 5 Jun 53, sub: same. ORDTU File, May - Jun 53, MRB GSA FRC.

[38](1) Ltr, 00 471 9/1258, CofOrd to CG, RSA, 19 Jun 53, sub: Proj TU2-1029, Whds for HJ. HJ R&D Case Files, Box 14-8, RHA AMSC. (2) HJ Blue Book, p. 68

Fragmentation Head, and practice and Spotting Head.[39]

(U) Another directive, issued by the General Staff in November 1953, emphasized that warhead deliveries would have to be made on a time scale compatible with rocket deliveries, and advised that the initial fragmentation-type head would be the T39 system then being developed for both the Honest John rocket and the Corporal Guided Missile.[40] In consonance with the latter decision, the Acting ACofS, G-4, then instructed the Chief of Ordnance to cancel all but 50 of the 173 T2021 Blast Warheads then under procurement, and to replace the 123 cancelled with T39 warhead systems. Procurement action on the latter units, however, would have to await the engineering design release and type classification sometime in March 1954. Since the same fuzing systems could be used with both types of warheads, the order for 173 each of the T1400 and T2039 fuzes was not changed.[41]

(U) Later in November 1953, the R&D Division, OCO, recommended that the T39 warhead system be provided for the practice and spotting head, mainly because it was already under development and would be available for production release earlier than any other comparable system. The requirement for a dummy or drill warhead could be easily met by adding spotting charges and/or fuzes to the inert (concrete ballast) warhead, which had been used as a simulated payload in some 100 R&D flight tests.[42]

(U) By February 1954, procurement action had been completed for 170 inert practice warheads, designated as the T2037, and 50 T2021 HE blast warheads, with complete delivery expected by April 1954. Early in that

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[39] Incl 1 to DF, G4/F4 39574, to CofOrd, 27 Aug 53, sub: Whd & Fuze Rqrmts for Sur to Sur GM and HJ Free Rkt. ORDTU File, Jul - Sep 53, MRB GSA FRC.

[40] DF, G4/H2 68058, to CofOrd, 12 Nov 53, sub: Whds for HJ Rkts. ORDTU File, Oct - Dec 53, MRB GSA FRC.

[41] (1) HJ Blue Book, p. 68. (2) TT SWSS 11-137, CofOrd to CG, RSA undated (o/a 16 Nov 53). ORDTU File, Oct - Dec 53, MRB GSA FRC.

[42] Memo, Chf, ORDIM, thru ORDTU, to Chf, ORDTA, 19 Nov 53, sub: Whds for HJ Rkt; and 1st Ind thereto, Chf, ORDTU, to Chf, ORDTA, 23 Nov 53. ORDTU File, Oct - Dec 53, MRB GSA FRC.

month, the General Staff approved procurement plans for T39 practice and spotting warheads, with deliveries to begin in August 1954.[43] A few weeks later, however, technical problems developed in the warhead and fuzing systems, and the entire program underwent reorientation.

(U) Initial flight tests of the T39 warhead system, conducted early in March 1954, were unsuccessful. The T2039 VT fuze functioned prematurely in two of the first five rounds, resulting in cancellation of the sixth scheduled firing for safety reasons. In an effort to solve the fuzing problem, the R&D Division, OCO, immediately arranged for five additional tests of the T39 system, using the T2039 VT fuze with a T3E1 timer.[44] However, because of the safety hazards involved and the fact that the T39 system did not simulate the tactical warheads being considered for the Honest John, the General Staff, in May 1954, directed that no further consideration be given to the T39 system as a practice and spotting head. The T39 system was also ruled out as the initial fragmentation-type warhead for the Honest John and Corporal, because its expected lethal radius fell short of the circular probable errors of the two weapons. The General Staff therefore decided to concentrate on development of two other fragmentation-type warheads having a greater lethal radius; namely, the T40 and T35 systems, the latter using a mechanical T3 timer with the T1400 as a back-up fuze.[45] Five years later, a modified version of the T39 system was adopted as a blast-type head for the M31 rocket, replacing the interim T2021 warhead.[46]

(U) As a result of the foregoing developments, the acting ACofS, G-4, cancelled the procurement plans for 123 T39 warhead systems and

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[43] Cmt 2, ACofS, G-4, to CofOrd, 3 Feb 54, sub: Whds & Whd Compartments for HJ Rkt. ORDTU File, Mar - May 54, MRB GSA FRC.

[44] (1) Memo, Chf, ORDTU, to Chf, ORDTX, 22 Mar 54, sub: Min of the GM Commodity Coord Conf 4 Mar 54. (2) Memo, Chf, ORDTU, to Chf, ORDIM, 23 Mar 54, sub: Rkts, M31, for T39 Sys Flt Tests. Both in ORDTU File, Mar - May 54, MRB GSA FRC.

[45] DF, G4/F4 31477, ACofS, G-4, to CofOrd, 8 Jun 54, sub: Whds & Fuzes for HJ and Corporal. ORDTU File, Jun - Aug 54, MRB GSA FRC.

[46] See below, p. 122.

reinstated the requirement for 123 T2021 HE blast warheads, thus restoring authorized procurement to the original total of 173. Since the results of flight tests had proved the T2039 VT fuze inadequate for the purpose intended, the Redstone Arsenal cancelled the order for 173 of these fuzes and arranged for delivery of the 173 blast warheads with the T1400 contact fuze only. To satisfy an additional Marine Corps requirement, the Redstone Arsenal later procured 20 more T2021 warheads with T1400 fuzing systems, making a total of 193 T2021 units and 170 inert (T2037) warheads for all Honest John rockets under procurement.[47]

(U) The ACofS, G-3, finally established firm warhead requirements for deployed Honest John rockets in late July 1954. For initial deployment, each reduced-strength battery was allocated 30 rockets, complete with compartment head, less warhead, these to be supplied concurrently with, or before, overseas deployment. An additional allowance of 20 rockets, complete with compartment heads and T2021 blast warheads, was authorized for each battery, these to be supplied on or after 1 January 1955 as they became available from production. The latter allocation represented an interim non-atomic warhead allowance, pending the availability of a more acceptable conventional warhead. The buildup to an authorized allowance of 135 rockets per battery was to be completed early in FY 1956.[48]

(U) The Picatinny Arsenal completed shipment of the 193 T2021 blast warheads in mid-1955. All development work on this interim warhead system ceased several months later; however, limited production continued.[49] Pending the development of a suitable practice and spotting warhead for

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[47] HJ Blue Book, pp. 68 - 69.

[48] DF, CofOrd to ACofS, G-4, 27 Jul 54, sub: Recommended Dplmt of HJ Rkts; and Cmt 2 thereto, G-4 to CofOrd, undated. ORDTU File, Jun - Aug 54, MRB GSA FRC.

[49] (1) Ltr, CG, PA, to CofOrd, 27 Jun 55, sub: Secondary Impact Fuzing Sys for Use with the HJ T2021 Rkt Whd (Fuze Kit, XM62). (2) 1st Ind, CofOrd to CG, PA, 13 Oct 55, on Ltr, (orig & date unk) sub: Status of T2021 Whd (Head, Rkt, HE, 762mm, T2021). Both in ORDTU File, May - Aug 55, MRB GSA FRC.

the Honest John, the T2021 HE blast warhead, equipped with a back-up fuzing system, had to be used for troop training purposes, in conjunction with the T2037 inert (concrete ballast) warhead.[50]

(U) The interim warheads issued to the initial Honest John units imposed severe limitations on essential troop training activities and also on the tactical use of the weapon system. Yet, firm requirements for the development of an adequate practice warhead were not generated by the user until the late spring of 1956—some 2 years after deployment of the first eight Honest John batteries.[51] In the absence of timely guidance on these and other warhead requirements, the project managers at the Redstone Arsenal could neither plan nor execute the program in an orderly, responsive manner. The confusion and frustrations still attending their effort in early 1956 are reflected in the following excerpt from an Honest John technical report.

> . . . Currently no funds are programmed for the Research and Development of a Practice Warhead for this Rocket System, or the procurement of an interim type. Repeated efforts to obtain information on . . . Warheads for the Honest John have failed. Due to this situation, Metal Parts Procurement has been curtailed, and it has become extremely difficult to plan and execute the Honest John Program so that a stockpile of Honest John Rockets could be obtained for emergencies. An urgent requirement exists for information on all types of Warheads for the Honest John as procurement at a reduced rate is continuing without benefit or knowledge of the quantities of various types of Warheads contemplated for future use.[52]

(U) Honest John Model 1236FF and the Father John (U)

(U) At the request of the Atomic Energy Commission, in February

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[50] (1) Memo, Chf, ORDTU, to Chf, ORDTA, 24 Jun 54, sub: T2021 Whd & Fuzing Sys for HJ; and 1st Ind thereto, Chf, ORDTA, to Chf, ORDTU, 12 Jul 54. (2) Ltr, G4/F4 32727, ACofS, G-4, to OCAFF, 30 Jul 54, sub: Practice Whds for HJ & Corporal. Both in ORDTU File, Jun - Aug 54, MRB GSA FRC.

[51] DF, LOG/E4-15810, DCSLOG to CofOrd, 1 Apr 56, sub: Practice Whds for HJ. ORDTU File, Jan - Apr 56, MRB GSA FRC.

[52] (1) HJ Blue Book, p. 69. (This technical report has a cut-off date of 30 June 1955 but contains information of a much later date.) (2) For the practice and tactical warheads subsequently developed for the Standard Honest John System, see below, pp. 119 - 22.

1952, the Redstone Arsenal initiated a project for the fabrication and flight test of five model 1236FF rockets to provide an overtest of XW-7 warhead components. Patterned after the Navy's "Big Stoop," the proposed vehicle consisted essentially of a 2-stage rocket fitted with an "outsized" set of fins and a Sandia telemetering warhead.[53] The Douglas Aircraft Company completed the engineering design study and submitted a formal cost proposal for the project early in April 1952.[54]

(U) Less than a month later, before contract negotiations could be completed, the Atomic Energy Commission dropped the 1236FF Model in favor of another design proposed by the Allegany Ballistics Laboratory. The alternate vehicle, known as the Father John, used the standard 1236F rocket in conjunction with supplemental Deacon rockets strapped to the motor body to provide additional thrust.[55] The Douglas Aircraft Company began a design study on the Father John, in June 1952, and later converted 10 standard 1236F rockets for use in the test program.[56] The Atomic Energy Commission supplied $160,000 for initial work on the Father John, together with an expenditure order for $2,338 to cover engineering costs incurred in connection with the 1236FF project.[57]

(U) The first two over-acceleration tests of XW-7 warhead components

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[53](1) TT S-20, AEC, Albuquerque, N.M., to DA, the Pentagon, 8 Feb 52. (2) Memo, Lt Col W.C. Ohl to Chf, ORDTU, 12 Feb 52, sub: Two-Stage HJ - Model FF. (3) Ltr, OO 471.9/1373, Coford to CO, RSA, 15 Feb 52, sub: HJ Model FF, 2-Stage Rkt, Proj TU2-1029B. All in ORDTU File, "Two-Stage Honest John Model FF, TU2-1029B - 1952," MRB GSA FRC.

[54]Ltr, DAC to LAOD, 4 Apr 52, sub: Cost Est on HJ Model 1236FF. HJ R&D Case Files, Box 14-90, RHA AMSC.

[55](1) TT FCDEV-80, CG, FC, AFSWP, Sandia Base, N.M., to CofOrd, 1 May 52. ORDTU File, 2-Stage HJ . . . 1952, MRB GSA FRC. (2) C.N. Hickman, "Father John - An Overtest Rocket for Honest John," 19 Apr 52. (This paper describes an earlier "Long John" proposal which led to the selection of the Father John.) ORDTU File, Mar - Apr 52, MRB GSA FRC.

[56](1) TT ORD-18862, CofOrd to CO, RSA, 10 Jun 52. ORDTU File, Jun 52, MRB GSA FRC. (2) Ltr, OO 471.91/2680, CofOrd to CG, RSA, undated (sent ORDGA 11 Aug 52), sub: Father John, Proj TU2-1029C, DA Pri 1A. ORDTU File, Jul - Aug 52, MRB GSA FRC. (3) HJ Blue Book, p. 8.

[57]RAD Order GC-3-804, OCO to CO, RSA, 2 Oct 52. HJ R&D Case Files, Box 14-90, RHA AMSC.

took place at the White Sands Proving Ground on 15 January and 25 March 1953, respectively. Father John Round 1 had six Deacon rockets, as compared to eight Deacons for the second round (see photograph), the purpose being to evaluate performance of components under different rates of thrust. Personnel of the Sandia Corporation indicated that the test objectives were successfully met in both trials.[58] The test crew fired the remaining Father John rounds later in 1953 and 1954.[59]

(U) In mid-December 1954, the Chief of Ordnance authorized the Redstone Arsenal to procure an initial supply of XM57 Adaption Kits for Honest John Atomic Warheads. By the end of that month, about 65 percent of these kits had been delivered.[60]

(U) Engineering-User Test Program (U)

(U) Despite the many problems and delays encountered during the crucial 1951 - 52 period, the rocket portion of the Honest John program had progressed amazingly well. By the middle of December 1952, the test crew at the White Sands Proving Ground had flight tested 64 of the Type I development rounds and completed engineering tests of the first 10 Type II R&D tactical prototypes. A few of the Type II production rockets had been finished, the schedule calling for deliveries in 1953 at the rate of about 30 per month.[61] Also, the Redstone Arsenal had initiated preliminary procurement actions, in November 1952, for the first volume production of 2,000 rockets to meet existing deployment schedules. At that time, four Honest John batteries had already been activated at cadre strength, with three others scheduled for activation

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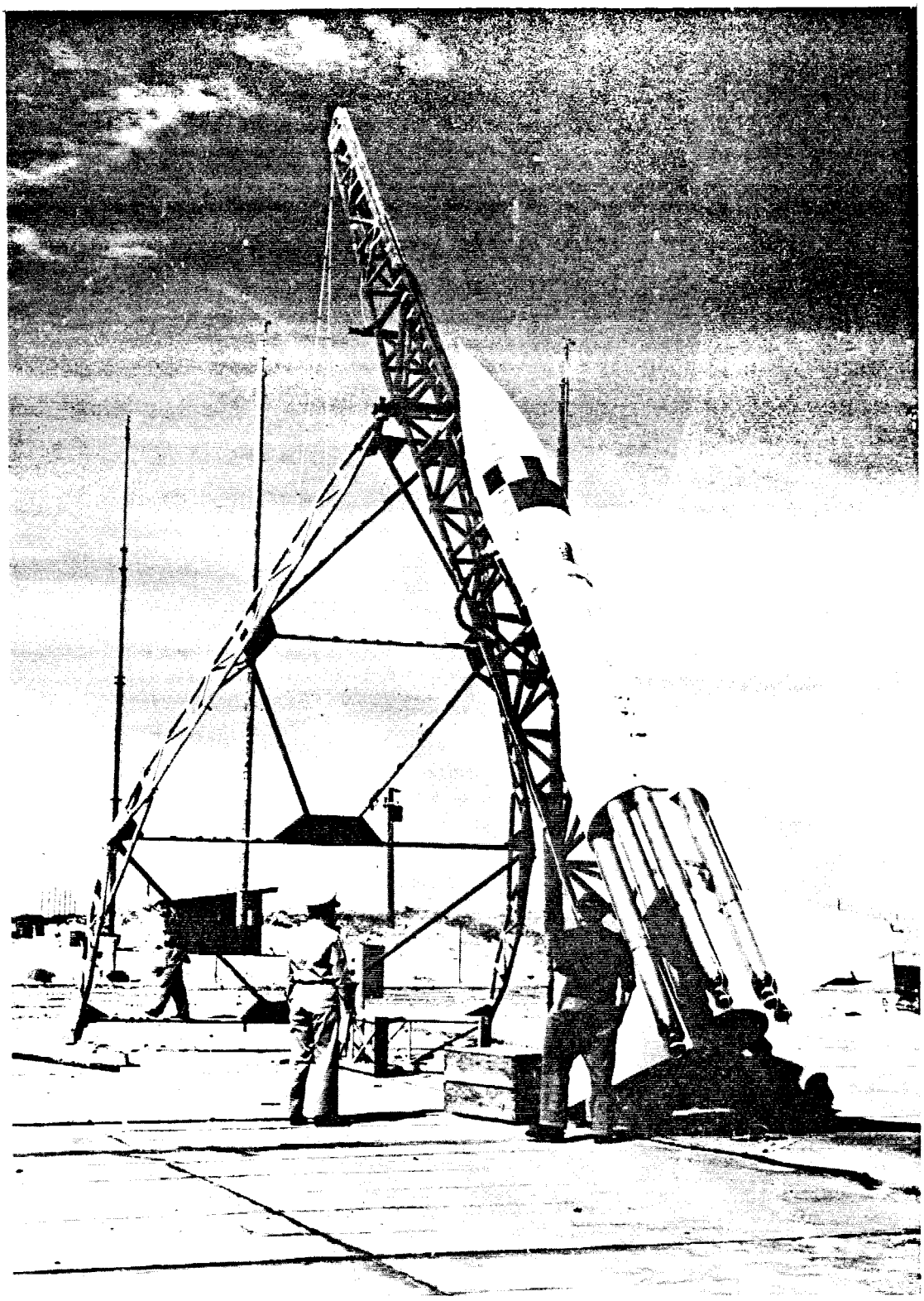
[58](1) TT ORDBS-STD TLX 1-42, CG, WSPG, to CofOrd, 21 Jan 53. (2) TT ORDBS-STD TLX 3-94, same to same, 26 Mar 53. (3) HJ Prog Rept, 20 Feb 53 - 27 Mar 53. All in HJ R&D Case Files, Box 14-8, RHA AMSC.

[59](1) HJ Prog Rept, Dec 53. ORDTU File, Oct - Dec 53, MRB GSA FRC. (2) RSA Hist Sum, 1 Jul 54 - 31 Dec 54, Vol II, p. 176. AMSC Hist files.

[60]HJ Blue Book, p. 68.

[61]The first 20 production rockets were allocated to the Chemical Corps for use in warhead development tests; the remaining rounds were earmarked for engineering and service tests and training purposes. Min of HJ Conf, 10 - 11 Dec 52. ORDTU File, Jan - Feb 53, MRB GSA FRC.



Father John Round No. 1 Showing Positioning of Deacon Rockets Around Motor (WSPG, March 1953.)

in Calendar Year (CY) 1953 and one in the first quarter of CY 1954. The deployment schedule then called for a limited operational capability by 31 December 1953.[62]

(U) At the end of 1952, the rocket portion of the program appeared to be in fairly good shape, but the launcher development effort at the Rock Island Arsenal had fallen some 6 months behind schedule.[63] Early in 1953, the rocket portion of the program itself suffered a serious setback because of a disturbing increase in average rocket dispersion. A detailed analysis of flight test data, available in early March 1953, revealed that the average range dispersion in recent firings had doubled that recorded in the first 39 development tests. Further investigation disclosed that the increased dispersion stemmed mainly from variations in total impulse of the XM6 JATO units being produced at the Radford Arsenal. The increased range dispersion at the lower temperatures pointed to the need for closer quality control to obtain a more uniform total impulse, and for some improvement in the propellant support and orientation in the rocket motor. Pending proof tests of the proposed corrective measures, the Under Secretary of the Army postponed volume production of 2,000 rounds and limited the FY-1953 procurement to 200 missiles.[64]

(U) Early in April 1953, the ACofS, G-4, allotted the Ordnance Corps 40 additional Type II rockets[65] for use in obtaining further

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[62] Ibid.

[63] See below, pp. 158 - 59.

[64] (1) 1st Ind, CG, RSA, to CofOrd, 15 Apr 53, on Ltr, CofOrd to CG, RSA, 17 Mar 53, sub: HJ Proj TU2-1029. HJ R&D Case Files, Box 14-8, RHA AMSC. (2) MFR, OCofS, DA, 23 Mar 53, sub: Proc of HJ Rkts, 20 Mar 53. ORDTU File, Mar - Apr 53, MRB GSA FRC. (3) DF, G4/F4-36527, ACofS, G-4, to CofOrd, 11 Jun 53, sub: Proc of 200 HJ Rkts. ORDTU File, May - Jun 53, MRB GSA FRC. (4) For technical details relating to corrective measures, see RSA Memo Rept ORDDW-TR-12, 26 Mar 53, sub: Analysis of HJ Range Dispersion Thru Round No. 90, and Corrective Measures Applied to the JATO, XM6. RSIC.

[65] From the 203 stockpile and training rounds produced under the initial industrial contract (ORD-342).

accuracy data.[66] Because of the extreme accuracy required of the data to be obtained from these firings, all conditions were very closely controlled to eliminate as much variation as possible. All components were of standard production manufacture, but special care was exercised to insure uniformity in weight, measurements, etc. To improve booster performance, the Radford Arsenal installed a grain alignment fixture (later adopted as standard for all rounds) to prevent shifting or malalignment of the grain during shipment. Qualified engineers from the Redstone Arsenal selected the components and supervised the assembly, handling, loading, and final inspection of each round.[67] These and other measures enabled the Arsenal to achieve the test objectives in less time and with fewer rounds than originally scheduled.

(U) Flight test of the first 20 rockets began at the White Sands Proving Ground on 20 June and continued through 29 June 1953. All of these rounds carried identical 1,500-pound concrete ballast heads, and all were temperature conditioned at 77°F. They were fired in ballistic pairs from the R&D launchers at a quadrant elevation (QE) of 35°. When compared with previous tests of rounds with dissimilar warheads, the results of these special firings indicated a vast improvement in both average range and range dispersion probable error (PE) as follows:[68]

	20-Round Accuracy Test (35° QE)	Previous Rounds (22.5° QE)
Mean Range.....	24,500 yards	18,500 yards
Actual Range PE.....	235 yards (.88%)	---
Corrected Range PE.....	161 yards (.66%)	249 yards (1.3%)
Actual Deflection PE.....	203 yards (7.6 mils)	---
Corrected Deflection PE...	155 yards (6.3 mils)	111 yards (5.9 mils)

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[66] Cmt 2, G4/F4-19259, G-4 to CofOrd, 3 Apr 53, sub: HJ Rkts for R&D Testing, DA Proj 517-07-027. ORDTU File, Mar - Apr 53, MRB GSA FRC.

[67] (1) Ltr, 00 471.9/610, CofOrd to CG, RSA, 6 Apr 53, sub: Accuracy of HJ Rkt, Proj TU2-1029, Pri 1A; and 1st Ind thereto, CG, RSA, to CofOrd, 17 Apr 53. HJ R&D Case Files, Box 14-8, RHA AMSC. (2) Memo, H. G. Jones, OCO-ORDTU, to ORDFI, 8 Apr 53, sub: HJ Rkts for R&D Testing. ORDTU File, Mar - Apr 53, MRB GSA FRC.

[68] Memo, Chf, ORDTU, to Maj Gen L. E. Simon, 15 Jul 53, sub: Rept of Actvs, Proj TU2-1029, HJ. ORDTU File, Jul - Sep 53, MRB GSA FRC. (For individual test results, see firing table [Rds 132 - 151] in appendix.)

The slight increase noted in the mean deflection error stemmed from the continuing lack of accurate equipment for the measurement of average surface winds over the first yaw cycle.[69]

(U) After a review of the above test results, in mid-July 1953, the Chief of Ordnance concluded that the accuracy required of the Honest John rocket had been successfully established, and therefore decided to hold the remaining 20 rounds for weapon system accuracy tests using tactical-type ground equipment. Since existing schedules indicated that the Honest John system would be issued to the troops before completion of the engineering-user tests, the ACofS, G-4, requested that the Army Field Forces be invited to participate in these firings as a part of the engineering-user test program.[70]

(U) The final R&D drawings and specifications, reflecting the latest design changes and quality control standards, became available for procurement release on 1 September 1953. Pending completion of service tests, the ACofS, G-4, type-classified the M31 rocket as substitute standard and approved the release of drawings for the first volume procurement in late September 1953.[71] The tactical M31 rocket initially issued to the troops consisted of the following major components:[72]

Compartment, Head, 762-mm. Rocket, M1

Fin Assembly, Rocket, M136

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[69](1) 1st Ind, CG, WSPG, to CG, RSA, 10 Sep 53, on Ltr (orig unk), 23 Jul 53, sub: Ord Proj TU2-1029, Inspection for HJ Rkt. ORDTU File, Jul - Sep 53, MRB GSA FRC. (2) For problems encountered in development of meteorological equipment, see section dealing with the AN/MMQ-1 Wind Measuring Set, pp. 193 - 99.

[70](1) Ltr, CG, BRL, APG, to CofOrd, 15 Jul 53, sub: HJ Accuracy Firings. (2) TT, CofOrd to CG, RSA, 15 Jul 53. (3) DF, G4/F4-54059, ACofS, G-4, to CofOrd, 2 Sep 53, sub: HJ Sys Test. All in ORDTU File, Jul - Sep 53, MRB GSA FRC.

[71](1) OCM 35008, 7 Oct 53; OCM 35002, 7 Oct 53. RSIC. (2) For the policy conflicts and delays attending these actions, see above, pp. 62 ff.

[72]Qtrly Prog Rept, Proj TU2-1029, 1 Sep - 20 Nov 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

Motor, 762-mm. Rocket, M3, consisting of:
Pedestal, 762-mm. Rocket, M2
JATO, 0.4-KS-640, M7 (T53)
Igniter, JATO, M28 (T29)
JATO, M6
Igniter, JATO, Electric, M29 (T30)

(U) Actual development of the Interim Honest John (M31) Rocket ended in January 1954, after 193 test firings.[73] During the period 28 January to 3 March 1954, the joint test crew at the White Sands Proving Ground conducted a series of 24 weapon system tests, combining production rockets and ground equipment, to determine the suitability and accuracy of the entire Honest John system under simulated tactical conditions. The results of these tests indicated that the following system accuracy could be expected of the tactical M31 Rocket - M289 Launcher combination:[74]

Range Probable Error - 248 yards, average
1.00% of range

Deflection Probable Error - 273 yards, average
11.2 mils

While the joint test report indicated that the weapon system was suitable for field artillery operations, it also pointed to several areas in which considerable improvement could be made. Subsequent engineering-user test firings were conducted from the M289 tactical launcher (rather than the fixed-base R&D launcher) in the continuing evaluation and improvement of weapon system performance.[75]

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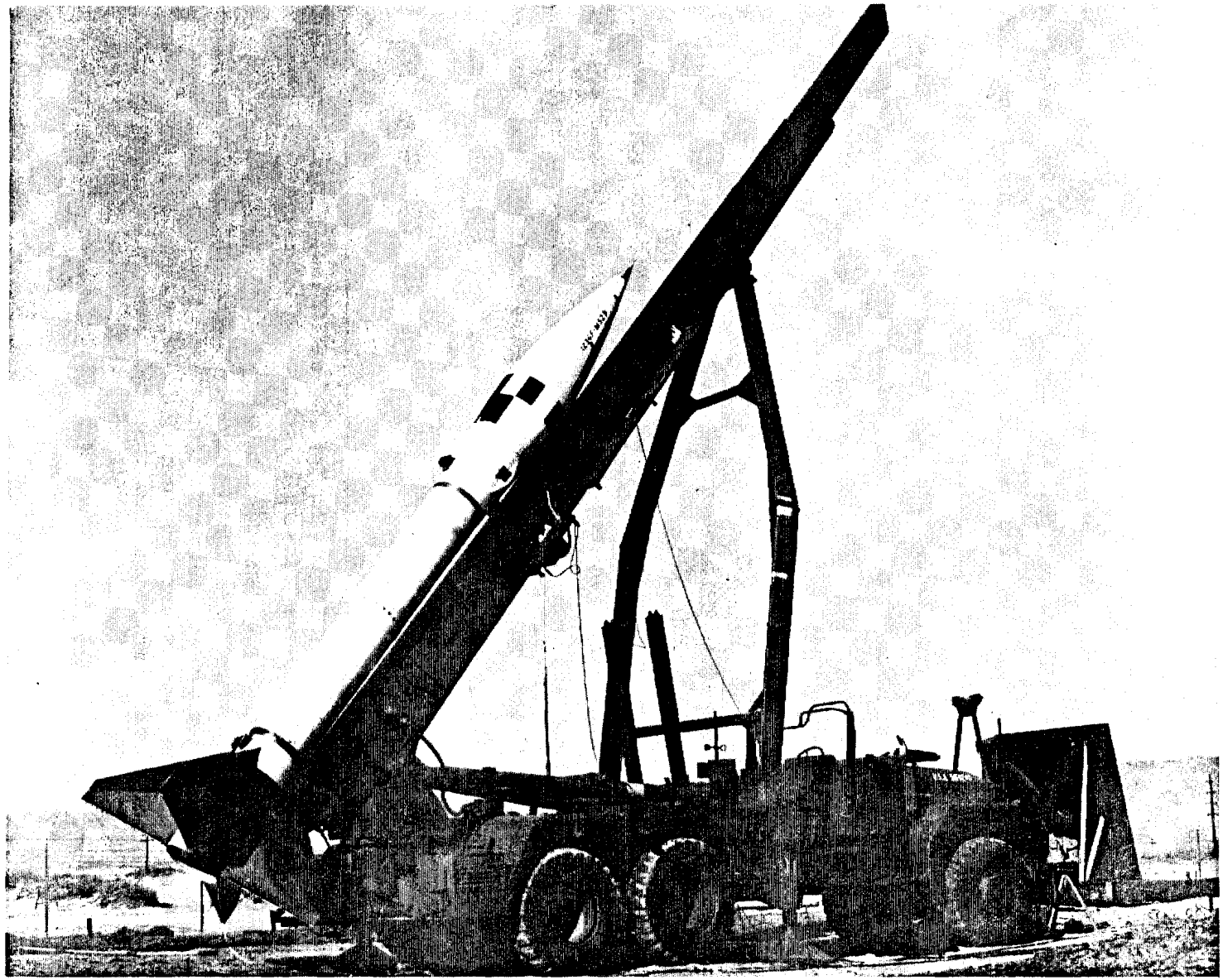
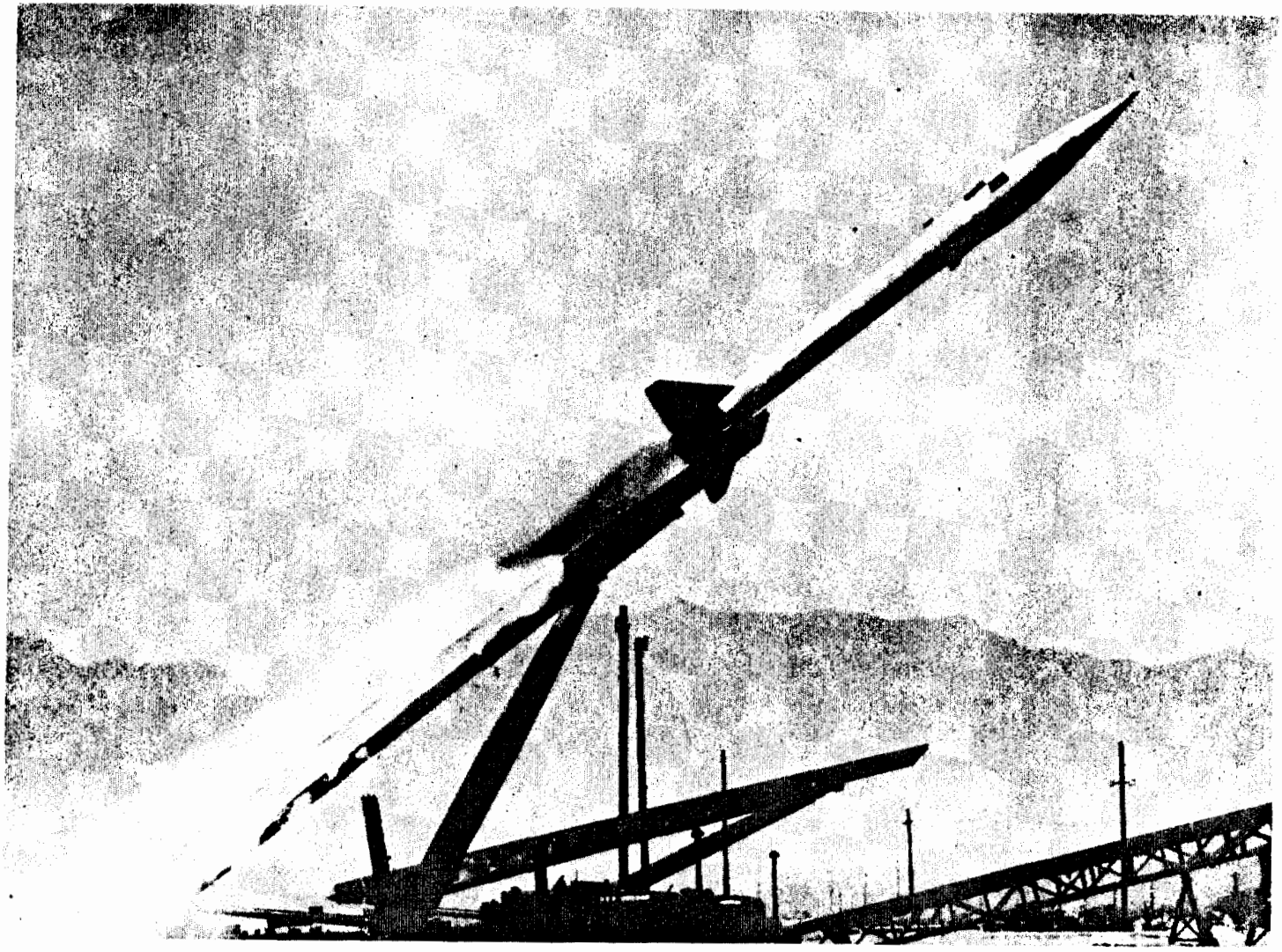
[73] DAC Rept No. SM-18650, 11 May 55, sub: Final Flight Test Report for Honest John Rounds 1 Through 193. RSIC. (See extract in appendix.)

[74] (1) DF, CofOrd to ACofS, G-4, 22 Apr 54, sub: Sys Test - 762mm Rkt, M31 (HJ). ORDTU File, Mar - May 54, MRB GSA FRC. (2) In comparing these weapon system accuracy figures with those obtained from the 20 special accuracy firings in June 1953, it must be remembered that the latter rounds were fired from the fixed-base R&D launchers under carefully controlled conditions and the results therefore reflected the accuracy of the rocket only, not the complete weapon system under tactical conditions.

[75] (1) DF, CofOrd to ACofS, G-4, 22 Apr 54, sub: Sys Test - 762mm Rkt, M31 (HJ). ORDTU File, Mar - May 54, MRB GSA FRC. (2) HJ Blue Book, p. 66. (3) Annual Prog Rept, Large Cal Arty Rkt (HJ), DA Proj 517-07-027, 31 Dec 54. ORDTU File, Sep - Dec 54, MRB GSA FRC.



Honest John Rocket Loaded on M289 Self-Propelled Launcher for Engineering-User Test—WSPG, 1954



Engineering-User Test Firing, White Sands Proving Ground, 1954.

CHAPTER V

(U) PRODUCT IMPROVEMENT AND INDUSTRIAL PROGRAMS (U)

(U) Both the product improvement and industrial programs began with the classification of the M31 rocket as substitute standard in September 1953. By the end of FY 1954, the first eight Honest John batteries had been equipped with the M31 system; second-source production contractors had been selected for the first volume procurement of 1,800 rockets; and the initial phase of the product improvement program was nearing completion. The basic design of the M31 rocket was frozen with the standardization of the M31A1 model in September 1954; however, development continued on a limited scale to eliminate equipment deficiencies, to define more accurately the operational characteristics of the M6 JATO, to effect minor changes involving safety and production economy, and to extend the short-range capabilities of the system. The product improvement effort ended with the final M31A2 model, which became available in mid-1959. Industrial procurement of M31 rockets (less warhead) continued through FY 1958, and production deliveries extended through the middle of FY 1961.

(U) Product Improvement Program (U)

(U) Though considered a basically acceptable weapon, the Honest John rocket initially placed in the hands of Army troops was by no means a fully reliable, perfected system. Most of the deficiencies remaining in the M31 rocket could be attributed to the telescoped program and the consequent sacrifice of quality for expediency. As a general rule, the engineering bugs fielded with such a system are worked out in an orderly product improvement program, the necessary component changes being issued to the field in adaption kits and authorized by Department of the Army Modification Work Orders. At the appropriate time, the design is then frozen, or stabilized, for the life of the system. In the case of the Honest John rocket, however, the product improvement program branched off into a two-pronged effort; the first dealing with correction of major deficiencies in the M31 rocket, and the other with development

of an improved, second-generation rocket known as the XM50.

(U) Standardization of the M31A1 Rocket (U)

(U) In resolving the technical deficiencies remaining in the M31 rocket, the developer was guided by the results of engineering-user tests which were continued after classification of the rocket as substitute standard. By the end of July 1954, the component changes necessary to correct major deficiencies had been completed and successfully proof tested; however, engineering-user tests of certain rocket components, particularly the various warhead installations, necessarily continued far beyond this point. Among the principal changes incorporated in the M31A1 rocket were modifications to permit installation of the M61 range zoning kit, use of the improved shockless igniter in the M6 JATO, and use of the BA605/U (Thermocell) dry battery in place of the Willard NT6 lead acid battery.

(U) After the release of R&D drawings, in September 1953, the M1 compartment head went through two design changes. The M1A1 compartment incorporated a new nose casting to permit installation of the T2039 fuze and a revised diaphragm to provide an access door for installation of the T1400 fuze. Further changes leading to the M1A2 compartment head included the addition of reinforcing bolts for installation of the M61 range zoning kit and a bulkhead forward of the hinged joint to accommodate the battery for the special warhead. Unlike other modified components, the M1 compartment heads in stock were issued without change until the supply was exhausted.

(U) Changes in the fin assembly entailed the application of new riveting specifications to strengthen the fin area and permit use of the range zoning kit. All M136 assemblies in stockpile were so modified.

(U) Of the five major elements making up the substitute standard M3 assembly, three were modified and accepted as standard items; the other two (M7 JATO and M28 igniter) remained in the substitute standard category pending completion of the qualification program. The M6A1 JATO, modified to accommodate the range zoning kit, was equipped with the new M35 electric igniter, an improved, shockless version of the previously

used M29 igniter. In the M2 pedestal, the Willard NT6 lead acid battery was replaced by the BA/605U dry battery which provided a "one-shot" power source for ignition of spin rockets and eliminated the battery-charging equipment previously required for the wet batteries.

(U) In late July 1954, the Subcommittee on Rockets and Launchers recommended that the Ordnance Technical Committee obtain General Staff approval for classification of the M31A1 rocket as standard type and the M31 as limited standard. The subcommittee's report stated that procurement of the M31A1 rocket, with modifications described above, would begin as soon as all new components could be phased into the production line. It also indicated that the estimated unit cost in quantity procurement would remain the same as the M31 rocket; i.e., $12,500 without warhead. The report was finally approved and published on 9 September 1954.[1]

(U) Modification of the Spin Rocket (M7 JATO) Assembly (U)

(U) This phase of the follow-on Honest John improvement program was concerned with the search for an improved JATO unit having a longer shelf-life and better ballistic and ignition qualities. The T53 spin rocket assembly had been a source of trouble in flight tests since late 1952, some firing too early, some too late, and some not at all. Moreover, its useful storage life was restricted to one year, while the main rocket could be stored for a much longer period.[2]

(U) The problem of ignition reliability was largely overcome in late 1954, when the Redstone Arsenal released the BA605/U thermocell battery for industrial rounds in place of the obsolete wet-cell battery. Redstone's Ordnance Missile Laboratories reported that this change

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[1] Subcommittee Rept U629 to Ord Tech Com, 26 Jul 54, sub: Rkt, 762mm, M31A1 - Clas as Std Type; Rkt, 762mm, M31 - Clas as Limited Std Type: Recorded & approved in OCM 35504, 9 Sep 54. RSIC.

[2] (1) HJ Blue Book, p. 12. (2) Ltr, 00 471.9/410, CofOrd to CO, PA, 5 Mar 53, sub: Proj TU2-1029, Large Cal Fld Rkt - HJ DA Pri 1A. HJ R&D Case Files, Box 14-8, RHA AMSC.

resulted in "numerous unofficial repercussions," but hastened to point out that in continuing flight tests with the dry-cell battery not a single spin rocket failure had occurred, whereas firings with the wet-cell battery had been from 10 to 20 percent failures. Furthermore, the BA605/U battery had the advantage of a longer storage life, and it made the M31 rocket completely independent of prefiring servicing operations between the operating-temperature limits.[3]

(U) The first phase of the search for a spin rocket assembly having a longer shelf-life culminated in two basic motor designs, both using a double-base extruded propellant in place of the polysulfide perchlorate composition used in the M7 (T53) JATO. The T53E1 JATO, developed by the Redstone Division of the Thiokol Corporation, used Thiokol TRX109 propellant, a nonstandard, single-orifice nozzle, and a standard igniter. The T53E3 motor, developed by the Picatinny Arsenal, used T19 propellant, standard metal parts, and a new igniter. In qualification static tests, conducted in June 1954, the T53E1 motor completed the program without difficulty and with improved ballistic performance over the M7 JATO; while the T53E3 motor exhibited an unacceptable ignition delay.

(U) A short time later, in July 1954, the M7 JATO failed to pass static acceptance tests for industrial procurement, because of pressures exceeding the hydrostatic pressure limits of the motor case. The Thiokol Corporation later reported that it was unable to correct the unacceptable pressures and strongly recommended that efforts to manufacture the M7 JATO be discontinued. The T53E1 JATO was offered as a solution to the problem; however, the existing industrial requirements could not be met with this motor because of the lead time involved for procurement of the nonstandard nozzle. The urgent need for an interim motor to replace the M7 JATO led to the selection of the T53E4 JATO, an alternate design similar to the T53E1 but having a standard nozzle. Upon completion of a static qualification program, in mid-October 1954,

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[3] RSA Hist Sum, 1 Jul 54 - 31 Dec 54, Vol II, p. 180. AMSC Hist Files.

the Redstone Arsenal recommended that the T53E4 JATO unit be released as a substitute standard item and that procurement be limited to a quantity of not more than 5,000 motors. It further recommended that the release of a standard item be delayed until all static and flight test data on the T53E1 and T53E3 could be evaluated.[4] The Chief of Ordnance approved these recommendations in November 1954. To provide replacements for M7 JATO's having 18 months' storage, the Redstone Arsenal increased the quantity of T53E4 motors from 5,000 to 8,000.[5]

(U) After an evaluation of data obtained from static and flight tests of the T53E1 and T53E3 motors, the Redstone Arsenal recommended that the T53E1 be selected for procurement release as a standard item. Subsequent action by the Ordnance Technical Committee standardized the T53E1 JATO as the M7A1.[6]

(U) Extension of Operating Temperature Limits, M6A1 JATO (U)

(U) The temperature range limitations imposed on the M6 JATO necessarily restricted the initial field use of the Honest John rocket and created many problems and complaints among Ordnance support and field artillery units. When first deployed, the M31 rocket could be fired only within a temperature range of +40°F. to +100°F., and its storage limitations were set at 0° to 120°F.[7] The problem here was that a cast double-base propellant grain of the size used in the M6 JATO had

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[4](1) Ibid., pp. 180 - 81. (2) Ltr, CG, RSA, to CofOrd, 28 Oct 54, sub: Ord Proj TU2-1029, Recmn for JATO M7 Replacement. ORDTU File, Sep - Dec, MRB GSA FRC.

[5](1) TT, CofOrd to CG, RSA, 16 Nov 54. (2) TT, CG, RSA, to CofOrd, 8 Dec 54. Both in ORDTU File, Sep - Dec 54, MRB GSA FRC.

[6](1) TT, CofOrd to CG, RSA, 5 Apr 55. (2) Ltr, 00/5U0-13565, CofOrd to CG, RSA, 6 Apr 55, sub: JATO T53E1 - RSA Rept No. 3M47P. Both in ORDTU File, Jan - Apr 55, MRB GSA FRC.

[7](1) In contrast, the approved military characteristics outlined in Ordnance Committee Minutes 34490, 20 November 1952, called for built-in characteristics which would permit operation in an air temperature range from -25°F. to +125°F., and permit storage from -80°F. to +160°F. (2) The Honest John Blue Book, page 47, states that the "desirable low [firing] limit is -40°F."

[redacted]

not been previously encountered; and extensive development and qualification tests were required to determine the actual storage and handling limits at extreme temperatures. Pending completion of this work and extension of the safe operating limits, it was essential that some means be provided for controlling the temperature of the propellant grain under extreme atmospheric conditions. The storage limitations, per se, presented no immediate problem, for adequate air-conditioning equipment could be provided to maintain the temperature within the established limits. However, in transportation, both to the tactical installation and between the battery assembly area and the launch site, the rocket would be exposed, for periods greater than allowable, to temperatures below the minimum and exceeding the maximum range.[8]

(U) To permit tactical use of the Honest John rocket under conditions commensurate with the military characteristics, the Ordnance Corps provided a conditioning cover which was supposed to hold the propellant temperature between +40°F. and +100°F. in ambient temperatures of about -40°F. to +140°F. It consisted of an electrically heated blanket tailored to fit the external surface of the rocket and serve as an insulating cover and heat source to maintain the desired temperature of the pre-conditioned JATO unit. The initial XM1 model, developed by the General Electric Company, failed to meet all military requirements; however, the Rock Island Arsenal procured a quantity of 150 for interim troop use until a better model could be developed.[9]

(U) The crash timetable necessary to achieve a limited operational capability by the spring of 1954 had left neither time nor equipment for environmental tests of the tactical system. In the last-minute rush to meet deployment schedules, the equipment had to be shipped directly from the production line to the using units. By the time a complete set of

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[8] 1st Ind, Act Dir, OML, RSA, to Chf, Fld Svc Div, 22 Dec 53, on Memo, Chf, Fld Svc Div, to Dir, OML, 11 Dec 53, sub: Temp Range Limits for JATO's XM5 and M6. HJ R&D Case Files, Box 14-8, RHA AMSC.

[9] The technical problems and delays encountered and the costly mistakes made in the execution of the blanket development program are detailed below, pp. 180 - 93.

[redacted]

JATO T53E1 (Spin Rocket)

equipment became available for cold room tests, in mid-1954, the first eight Honest John batteries had been organized and were already in training. In June 1954, the Chief of Ordnance drew up tentative plans to begin Arctic tests of the Honest John system at Fort Churchill, Canada, early in 1955. Since all available prototype equipment would still be needed for continuing development of the system, he suggested that the Army Field Forces provide personnel and equipment for the tests from one of the rocket batteries then in training.[10] The Army Field Forces later placed a requirement for low-temperature tests of rockets carrying high-explosive heads with dummy components of the W-7 warhead. Because of legal restrictions against firings of this nature on foreign soil, the ACofS, G-3, directed, in October 1954, that the test site for combined engineer-user tests be moved to Big Delta (Fort Greely), Alaska. At about the same time, the tests planned for early 1955 had to be rescheduled for the next winter because of supply shortages.[11]

(U) Early in 1955, the Ordnance Corps initiated a propellant research project under the Honest John Improvement Program, the ultimate objective of which was to perfect an improved motor with an operating temperature range of -20°F. to +130°F., and thereby eliminate the need for the electric blanket and associated power generating equipment. By early August 1955, 12 rockets had been successfully fired at high temperatures, but attempts to fire low-temperature rockets in conjunction with other programs failed owing to interference of requirements of such programs and difficulties with instrumentation not connected with the extended temperature work. Progress on this program was then delayed

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[10](1) HJ Blue Book, pp. 130 - 39. (2) Memo, Chf, ORDTU, to Chf, ORDFQ, 17 May 54, sub: XM289 Lchr No. 24 for Cold Test. ORDTU File, Mar - May 54, MRB GSA FRC. (3) Ltr, 00/4C-11747, CofOrd to Chf, AFF, 3 Jun 54, sub: Conduct of Low Temp Tests, HJ Rkt Sys, Ft Churchill, Canada. ORDTU File, Jun - Aug 54, MRB GSA FRC.

[11](1) Ltr, ATDEV-10 471.94, OCAFF to ACofS, G-3, 8 Sep 54, sub: Conduct of Low Temp Tests, HJ Rkt Sys, Ft Churchill, Canada; 1st Ind thereto, ACofS, G-3, to Chf, AFF, 13 Oct 54. (2) TT DA968013, CofOrd to CG, WSPG, 20 Sep 54. All in ORDTU File, Sep - Dec 54, MRB GSA FRC.

pending receipt of 12 additional test vehicles.[12]

(U) Meanwhile, the Redstone Arsenal continued work on a parallel program aimed at extending the operating temperature limits of the M31A1 rocket (M6A1 JATO) already in the hands of troops. At the end of June 1955, the Arsenal had completed successful static firings at temperatures of 0°F. to +120°F., and accepted a number of industrial rounds for final qualification firings. The immediate objective was to complete the latter program and release the new motor specifications by October 1955, so that adequate rounds would be available for field use in the coming winter.[13] This objective was not fully achieved until the summer of 1956, with the result that serious motor trouble developed in those units stationed in extremely cold climates. For example, Arctic tests of the Honest John system, conducted in Alaska early in 1956, disclosed, among other things, that the XM1 Electric Blanket and power generating equipment were not capable of maintaining the temperature of the M6A1 JATO within permissible firing limits (+40°F. to +100°F.). Also, a similar problem was experienced by units in the Seventh Army Area (Stuttgart, Germany), where battalion commanders were actually compelled to suspend motor lots because the grain temperature fell below the prescribed safe-firing limit.[14]

(U) In establishing corrective measures for these and numerous other deficiencies in the M31A1 rocket and ground equipment, the Ordnance Corps necessarily followed a dual approach. In those cases where deficiencies could be corrected without extensive redesign, appropriate modification kits were provided for retrofit action in the

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[12] Memo, Chf, ORDTU, to Chf, ORDFI, 9 Aug 55, sub: Req for Alocn of Rkts M31A1 (HJ); 1st Ind thereto, Chf, Ammo Br, Fld Svc Div, OCO, to Chf, ORDTU, 18 Aug 55. ORDTU File, May - Aug 55, MRB GSA FRC.

[13] RSA Hist Sum, 1 Jan 55 - 30 Jun 55, II, 130. AMSC Hist Files.

[14] Ltr, CofOrd to CG, CONARC (formerly the Army Field Forces), 9 Oct 56, sub: Tentative Rept of Proj No. FA 2654, Low Temp Test of HJ Rkt Sys (DA Proj 5-17-05-008; RDB Tech Obj LC-4). ORDTU File, Sep - Dec 56, MRB GSA FRC.

field.[15] Corrections for the more complex deficiencies, which required major modifications beyond the scope of the basic product improvement program, were incorporated in the Improved XM50 Rocket System then under development. Most of the shortcomings noted in the M31A1 system properly fell in only one of these categories. However, there were a few deficient components, such as the motor and temperature conditioning equipment, which restricted the tactical use of the system and therefore demanded corrective action in both phases of the improvement program.[16]

(U) Early in 1956, the project engineers at the Redstone Arsenal redoubled their efforts to extend the operating temperature limits of the M31A1 rocket and thus lessen the requirements imposed on the blanket and power generator. Through extensive testing and closer quality control, they succeeded in extending the safe firing limits of the M6A1 JATO from +40°F. - +100°F., to 0°F. - +120°F., and the operating temperature limits of the M35 JATO igniter from +30°F. - +110°F. to a range of -10°F. - +130°F. In an operation known as "Project Retest," Redstone Arsenal personnel conducted retests of all Honest John rounds in the field to qualify them for firing at the extended temperature limits.[17] To distinguish this retest rocket (with firing, storage, and handling temperature limits of 0°F. to +120°F.) from the M31A1 model, the Ordnance Industrial Division simply added a "C" to the basic code

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[15] As a general rule, the field modification kits were the end result of coordinated actions among Redstone Arsenal's three mission divisions, representatives of each organization usually meeting in informal conferences to discuss pertinent technical requirements, funding, documentation, etc. After establishing the desired course of action, the Rocket Development Division forwarded the necessary drawings and specifications to the Industrial Division which, in turn, supplied the Field Service Division with field modification kits and appropriate documentation for Department of the Army Modification Work Orders. As the distribution agency, the Field Service Division shipped the kits to all Army units in the field and to stockpiles at Ordnance Depots.

[16] 1st Ind, CofOrd to CG, CONARC, 31 Oct 56, on Ltr, (orig unk), sub: Tentative Rept of Proj No. FA 2654, Low Temp Test of HJ Rkt Sys . . . . ORDTU File, Sep - Dec 56, MRB GSA FRC.

[17] (1) Ibid. (2) RSA Hist Sum, 1 Jan 56 - 30 Jun 56, Vol II, p. 179.

designation so that it became the 762-mm., M31A1C rocket.[18]

(U) Standardization of the M31A1C Rocket (U)

(U) By the fall of 1956, the M31A1C rocket had been placed in production, along with the improved XM2 Electric Blanket.[19] The Ordnance Technical Committee had also reclassified the M31A1 rocket as limited standard and designated the M31A1C model as the standard military item.[20] This improved rocket and blanket combination provided the using services a much more flexible system, but constant surveillance and protective measures were still essential, particularily in sub-zero weather.[21]

(U) XM4 Practice Warhead for M31 Rocket (U)

(U) The Basic Honest John System had been released to field units as a standard weapon without an adequate practice warhead.[22] The interim T2021, 1,500-pound, HE Blast Warhead was too lethal for use in practice and it had no air-burst capability. While the T2037 concrete ballast warhead was available for limited use in troop training, it was inert and unsatisfactory for firing. Despite the severe limitations thus imposed on essential troop training activities, firm requirements for development of even an interim practice head were not forthcoming from the General Staff until the spring of 1956.

(U) Early in April the Deputy Chief of Staff for Logistics (DCSLOG) directed the Chief of Ordnance (1) to provide an "interim" air-burst

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[18] Memo, Chf, ORDTU, to Chf, ORDID-E, 14 Mar 56, sub: Nomen Asgmt; & 1st Ind, Chf, ORDID, to Chf, ORDTU, 28 Mar 56. ORDTU File, Jan - Apr 56, MRB GSA FRC.

[19] See below, p. 188f.

[20] OCM 36323, 4 Oct 56. RSIC.

[21] (1) Ltr, CG, RSA, to CofOrd, 10 Sep 56, sub: Tentative Rept of Proj FA 2654, Low Temp Test of HJ Rkt Sys (DA Proj 5-17-05-008; RDB Tech Obj LC-4). (2) Ltr, CofOrd to CG, CONARC, 9 Oct 56, sub: same. Both in ORDTU File, Sep - Dec 56, MRB GSA FRC.

[22] See above, pp. 94 - 95, 97 - 98.

practice head capable of emitting sufficient smoke to be easily seen in daylight and sufficient flash to be seen at night, and (2) to provide funds to initiate development of an "optimum" practice head which would be compatible with both the M31 rocket and the Improved XM50 Rocket. In consonance with the urgency of the program, he authorized procurement of the interim warhead before type classification as standard. Specifically, the Chief of Ordnance was to procure, on an "expedited basis," 38 T2037 Inert Warheads plus 512 additional (T2037) heads capable of modification to meet the specified smoke and flash requirements.[23]

(S) In late April 1956, the Redstone Arsenal received instructions to expedite development of the interim practice head so that the R&D drawings would be ready for production release by November 1956.[24] The approved military characteristics for the XM4 Flash-Smoke Head reached the developing agency in late July 1956 and work on the project proceeded under a 1A priority.[25] The Picatinny Arsenal designed the warhead and fabricated the pyrotechnic charges with fuzes for selective air or ground burst. Ballast assemblies were built by the Watertown Arsenal.[26]

(U) The development program provided for 15 R&D flight tests with the M31A1C rocket, plus some 22 engineering and user tests, the prime objective being to establish the technical adequacy and suitability of the warhead design. Feasibility tests of the warhead began early in September 1956. By mid-November, 11 of the 15 R&D tests had been completed, including some night firings. The results of these tests indicated that the design was basically adequate; however, they did not

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[23] DF, LOG/E4-15810, DCSLOG to CofOrd, 1 Apr 56, sub: Practice Whds for HJ. ORDTU File, Jan - Apr 56, MRB GSA FRC.

[24] TT, CofOrd to CG, RSA, 26 Apr 56. ORDTU File, Jan - Apr 56, MRB GSA FRC.

[25] (1) Ltr, CG, WSPG, to CofOrd, 13 Nov 56, sub: Transmittal of Test Program; and Incl 1 thereto, "Engineering Test Program on Head, Flash-Smoke, 762mm, XM4 (Practice Warhead)." ORDTU File, Sep - Dec 56, MRB GSA FRC. (2) OCM 36478, 14 Mar 57. RSIC.

[26] (1) RSA Hist Sum, 1 Jul 56 - 31 Dec 56, II, 245. AMSC Hist Files. (2) OCM 37143, 6 Aug 59. RSIC.

yield sufficient engineering data to support a production release by the established target date of November 1956. Engineering data was yet to be collected on the ability of the warhead to withstand tactical transportation conditions, long-term storage, and other normal safety hazards incident to loading, unloading, handling, mating, and firing. Also, engineering tests were required to establish the reliability of the warhead.[27]

(U) To expedite the engineering evaluation, the Redstone Arsenal used the remaining four R&D rounds for combined R&D-engineering tests, and released the drawings for limited procurement of the XM4 warhead as a substitute standard item on 7 January 1957. In October of that year the Continental Army Command completed an evaluation of the refined XM4E1 warhead design in a series of 22 flight tests with the M31A1C rocket. The results of these user tests indicated that the warhead was reliable and generally met the established military characteristics; however, minor design changes were necessary to achieve maximum safety. Later in 1957, the Redstone Arsenal procured 173 of the XM4E1 practice heads for delivery to troop units in 1958.[28]

(U) The XM4E1 practice head was later succeeded by two improved models designated as the XM4E3 and XM4E4. An Ordnance Technical Committee action, approved in late May 1960, classified the M4 (XM4E3) and M4A1 (XM4E4) Flash-Smoke Practice Heads as Standard "C" types and reclassified the XM4E1 from limited production to obsolete type.[29] Procurement of this interim practice head continued through FY 1959. The "optimum" XM38 practice head, designed for use with both the M31 and XM50 rockets, was classified as limited production type in December 1959,

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[27] TT ORDBS-5268, CG, WSPG, to CofOrd, 15 Nov 56. ORDTU File, Sep - Dec 56, MRB GSA FRC.

[28] (1) RSA Hist Sum, 1 Jul 56 - 31 Dec 56, II, 245. (2) RSA Hist Sum, 1 Jul 57 - 31 Dec 57, II, 172. Both in AMSC Hist Files. (3) OCM 37143, 6 Aug 59. RSIC.

[29] OCM 36969, 19 Feb 59; OCM 37411, 26 May 60. RSIC.

followed by classification of the final M38 (XM38E1) Flash-Smoke Practice Head as Standard "A" type in September 1962.[30]

(U) Tactical Warheads (U)

(U) The tactical warhead assemblies designed for exclusive use with the M31 series rocket embraced the M6 (T2043E1) HE Warhead; the M57 (T39E4) Blast-Type HE Warhead; and the M57A1 (XM57E1) Adaption Kit for the W-7 warhead installation, the latter being developed and stockpiled by the Atomic Energy Commission. The M6 (T2043E1) HE Warhead was standardized as the primary conventional warhead for the M31 rocket in December 1956. It remained on the Army's shopping list through FY 1959, at which time procurement and production shifted to the interchangeable T2044E1 head assembly later standardized as the M144.[31]

(U) The T39E3 HE Warhead was introduced as a limited production item in 1959 to provide a more acceptable blast-type warhead than the interim T2021 system then in use. With minor changes in the impact fuzing system, the T39E3 was redesignated the T39E4 and standardized as the M57 HE Warhead in September 1960. About 550 were procured in FY 1959 as replacements for the interim T2021 system.[32]

(U) Engineering-user tests of the XM57E1 Adaption Kit for the W-7 warhead were completed late in 1959. The Army General Staff approved the type classification of the M57A1 as Standard "C" in July 1960. Between 1958 and 1960 some 589 M57A1 kits were procured for use with the M31 rocket. Production of the interchangeable M86 Adaption Kit began in 1958.[33]

(U) Design of the Final M31A2 Rocket

(U) This final version of the M31 series became available in

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[30] OCM 37264, 17 Dec 59; AMCTC 135, 24 Sep 62. RSIC.

[31] OCM 36401, 13 Dec 56; OCM 37150, 6 Aug 59; OCM 37339, 28 Jan 60. RSIC.

[32] OCM 36996, 19 Feb 59; OCM 37543, 29 Sep 60. RSIC.

[33] OCM 36748, 13 Mar 58; OCM 37444, 26 May 60; OCM 37492, 7 Jul 60. RSIC.

mid-1959 and incorporated certain industrial engineering improvements to the M31A1C rocket. It consisted of an improved spin rocket motor, designated as the M7A2B1; a new JATO igniter, designated as the M35A2; and a new M6A2 rocket motor. The latter component, as a loaded assembly, provided for the use of the one-piece M35A2 igniter; eliminated the need for an internal wiring harness assembly; and provided for the use of a one-piece, molded plastic closure nozzle assembly.

(U) Beginning with the initial production deliveries in June 1959, and continuing through mid-December 1962, the M31A2 rocket supplemented the M31A1C model as Standard A Type. On 13 December 1962, the Army Materiel Command Technical Committee reclassified the M31A1C and M31A2 from Standard A to Standard B Type, and declared the earlier M31 models obsolete. At the same time, the committee reclassified the Improved M50 Honest John Rocket from Limited Production to Standard A Type.[34]

(U) Summary of Final System Development and Test Operations (U)

(U) The development phase of the Basic Honest John (M31) Product Improvement Program continued on a crash basis from the fall of 1953 through CY 1957, with Phases II, III, and IV being conducted simultaneously. As of 20 November 1953, a total of 185 M31 rockets had been expended in flight tests at the White Sands Proving Ground. Both the firing tables and a series of warhead tests for the Atomic Energy Commission had been completed, but other warheads and fuzing systems remained to be developed and tested in the continuation of the Phase II effort.

(U) By 31 December 1954, 172 more M31 rockets had been flight tested, bringing the total rounds expended in all phases to 357. The firing tables had been published by the Aberdeen Proving Ground; accuracy and system tests had been completed under Phase III of the program. Typical of the firing schedules for the overall program were those for the last 6 months of 1954, when a total of 60 rounds was fired in the

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[34] OCM 37468, 26 May 60; AMC Tech Committee Item 364, 13 Dec 62. HJ/LJ Commodity Ofc Files, AMICOM.

three phases, as follows: Phase II (R&D Warhead Support), 19 rounds; Phase III (Engineering and Engineering-User Support), 28 rounds; and Phase IV (Industrial Tests), 13 rounds.[35]

(U) In November 1954, shortly after standardization of the M31A1 rocket, the Douglas Aircraft Company gave a presentation at the Office, Chief of Ordnance, on the accuracy of the tactical Honest John system. This presentation led to the initiation of an Honest John Improvement Program, the main objectives of which were to increase system accuracy, to improve operational suitability, and to extend the effective range. As initially established in early 1955, the program entailed a major product improvement to the standard (M31) rocket, the first two phases being scheduled to run concurrently with the remainder of Phases III and IV of the Basic Product Improvement Program. Phases I and II of the Improvement Program were expected to be completed by the end of 1957 and Phase III by the middle of 1958.[36]

(U) Beginning in the spring of 1955 and continuing through 1957, the development and test agencies thus conducted both improvement programs as an integrated effort, modified M31 rockets being used as the delivery system in the research test phase of the new program.[37] During the 3-year period, January 1955 - December 1957, the test crew at the White Sands Proving Ground conducted about 353 rocket firings in all phases of the integrated improvement effort, with primary emphasis on warhead and launcher development.[38]

(U) The year 1958 was characterized by major changes in both the management and direction of the Honest John improvement programs. Up

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[35] Eunice H. Brown, et al., "Development & Testing of Rockets & Missiles at White Sands Proving Ground, 1945 - 1955," (Hist Info Br, WSMR, 1 Oct 59) pp. 167 - 68.

[36] Ibid., p. 171. (2) HJ Blue Book, p. 49.

[37] Honest John Missile System Plan, ARGMA MSP-11, 1 Jun 60, p. 38-D.

[38] (1) Brown, op. cit., p. 168. (2) William R. Stevenson, et al., "Development and Testing of Rockets & Missiles at White Sands Missile Range, 1956 - 1960," (Hist Br, WSMR, 27 Jul 61) pp. 200 - 207.

to the end of March 1958, the responsibility for technical supervision and management of the Honest John and certain other weapon system programs had rested with the Commanding General of the Redstone Arsenal who reported directly to the Chief of Ordnance. Effective 31 March 1958, the Department of the Army created the Army Ordnance Missile Command (AOMC) at Redstone Arsenal, Alabama, and delegated it full responsibility and authority for the management and direction of some 15 major weapon system programs. Concurrently, the Redstone Arsenal, the White Sands Proving Ground, the Army Ballistic Missile Agency, and the Jet Propulsion Laboratory were assigned to, and became subordinate elements of, the AOMC Headquarters. The Army Rocket and Guided Missile Agency (ARGMA) was then organized as a subordinate element of the AOMC, on 1 April 1958, and assumed responsibility for the technical missions formerly assigned to the Redstone Arsenal, including the Honest John program.[39]

(U) The resulting system of centralized commodity management not only eliminated duplication of effort and personnel, but also speeded up the execution of weapon system programs through faster and less formal coordination, quicker policy decisions, and more responsive technical guidance.[40] It was not established and implemented in time to have any appreciable influence on the Basic Honest John Program; but its impact on the existing product improvement effort was swift and decisive.

(U) Since early 1955, the program had consisted of a dual improvement effort: continuing tests and evaluation of the standard M31 series under the basic program; and feasibility studies and research test firings under the newly established improvement program. Hindered by lack of funds and firm direction, work on the latter program had proceeded on an intermittent basis, directives and decisions from higher authority ranging from complete suspension of effort, to a

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[39] (1) DA GO 12, 28 Mar 58. (2) Ord Corps Order 6-58, 31 Mar 58. (3) AOMC GO 6, 1 Apr 58.

[40] Helen Brents Joiner, "History of Headquarters U. S. Army Ordnance Missile Command, Redstone Arsenal, Alabama, 31 March - 30 June 1958," (AOMC, 1 Nov 58) pp. 2 - 6.

modified M31 rocket program, and finally to consideration of a completely new weapon system development. The preliminary feasibility study and research test firings, completed in the fall of 1956, had resulted in a contractor proposal for a completely new weapon system, including a new motor, new warheads, and a new launching equipment. Some of the new components, such as the warhead sections, were compatible and suitable for use with both the standard M31 rocket and the improved XM50 rocket; however, the latter had emerged as an entirely new design, rather than a major product improvement to the standard system as originally intended. Nevertheless, work on minor improvements to the basic system and the fabrication of XM50 R&D test vehicles was still being conducted as a parallel product improvement effort as late as the spring of 1958. Moreover, the Army General Staff still had not reached a definite decision to continue XM50 development to completion; and indeed the Chief of Ordnance had no assurance that it would be continued beyond the scope of the FY-1958 funding program.[41]

(C) Such was the state of the Honest John program when the new AOMC organization assumed control in April 1958. The first R&D flight test of the XM50 rocket took place in mid-June 1958 and successful warhead tests followed in August. Based on the results of these tests, the Commanding General of the AOMC pressed higher headquarters for authority and funds to complete development of the improved XM50 rocket as a separate weapon system. Promptly overturning an earlier decision, the Army Chief of Staff, in September 1958, directed the Chief of Ordnance to continue to completion the Honest John Improvement Program.[42] The AOMC received full FY-1959 funding in February 1959. By the end of August 1959, action had been taken to consolidate the Honest John Improvement Program (including the rocket and ground equipment) under a new project—DA Project 517-07-027 (TW-200)—and to terminate certain

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[41](1) OCM 37143, 6 Aug 59. RSIC. (2) HJ Msl Sys Plan, ARGMA MSP-11, 1 Jun 60, pp. 1-A, 38-D. (3) HJ Hist Sum, FS thru 31 Oct 58, pp. 8, 9.

[42]Ibid., p. 9.

development tasks in the basic program which involved components and equipment no longer required.[43]

(U) Meanwhile, the White Sands Missile Range—formerly the White Sands Proving Ground[44]—continued flight tests of both the M31 and XM50 rockets. Testing of the M31 series began phasing out in the latter part of 1958. Subsequent flight tests in this series consisted mainly of warhead tests which used the rocket as a delivery system only, and acceptance tests of rockets from the last production contracts. The number of M31 firings decreased from 127 in 1958, to 65 in 1959, and on to a low of 30 in 1960. During the period 29 June 1951 (first Honest John firing) to 31 December 1960, the White Sands Missile Range flight tested a grand total of 1,037 rounds in all phases of the Basic Honest John Program.[45]

(U) The Demijohn Program

(U) The history of the Honest John rocket would not be complete without at least a brief account of the Demijohn program and the attempt to provide the basic system with an effective short-range capability. The Rocket Branch of the R&D Division, OCO, originated the preliminary study program, in March 1952, on the assumption that tactical use of the Honest John rocket would include a short-range limit considerably below the currently established minimum of 20,000 yards. At that time, Mr. H. G. Jones, chief of the Rocket Branch, advanced the idea that a minimum range of 5,000 yards might be realized through the use of spoilers, or drag brakes, affixed to the standard 1236F rocket.[46] The Douglas Aircraft Company completed a brief theoretical analysis of the problem, in May 1952, and a more detailed design study in the spring

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[43] OCM 37143, 6 Aug 59. RSIC.

[44] Renamed effective 1 May 1958. DA GO 14, 19 Apr 58.

[45] Stevenson, "Development and Testing of Rockets & Missiles at White Sands Missile Range, 1956 - 1960," pp. 208 - 09, 216, 219 - 20.

[46] Ltr, ORDTU, OCO, to ROO, DAC, 14 Mar 52, sub: Short Range Dispersion of HJ, Proj TU2-1029, DA Pri 1A. HJ R&D Case Files, Box 14-9, RHA AMSC.

and summer of 1953.[47] The proposed configuration—designated as the Demijohn—consisted essentially of two collar-type spoiler plates bolted to each side of the standard rocket, as shown in the accompanying photograph.

(U) In October and November 1953 the Ordnance-Douglas team flight tested six experimental models of the Demijohn to demonstrate the feasibility of the system in the short-range role. The first firing was marred by a fin failure, but the remaining five tests proved successful in both range and deflection error.[48] Having thus proved—at least superficially—that the Demijohn would provide the Honest John system with an effective short-range capability, the Chief of Ordnance set out to sell the idea to the Army Field Forces.

(U) At first, the Field Forces rejected the proposal on the grounds that the minimum range flexibility would be obtained at the expense of a reduction in the maximum range of the Honest John system. But the Chief of Ordnance argued that this flexibility was a proposed addition to the system which would make the requirements for firing position selection less stringent and permit greater battlefield coverage per given number of Honest John units. Moreover, it could be made available at low cost[49] with maximum simplicity.[50] The Chief of the Army Field Forces then indicated in May 1954, that the flexibility of minimum range

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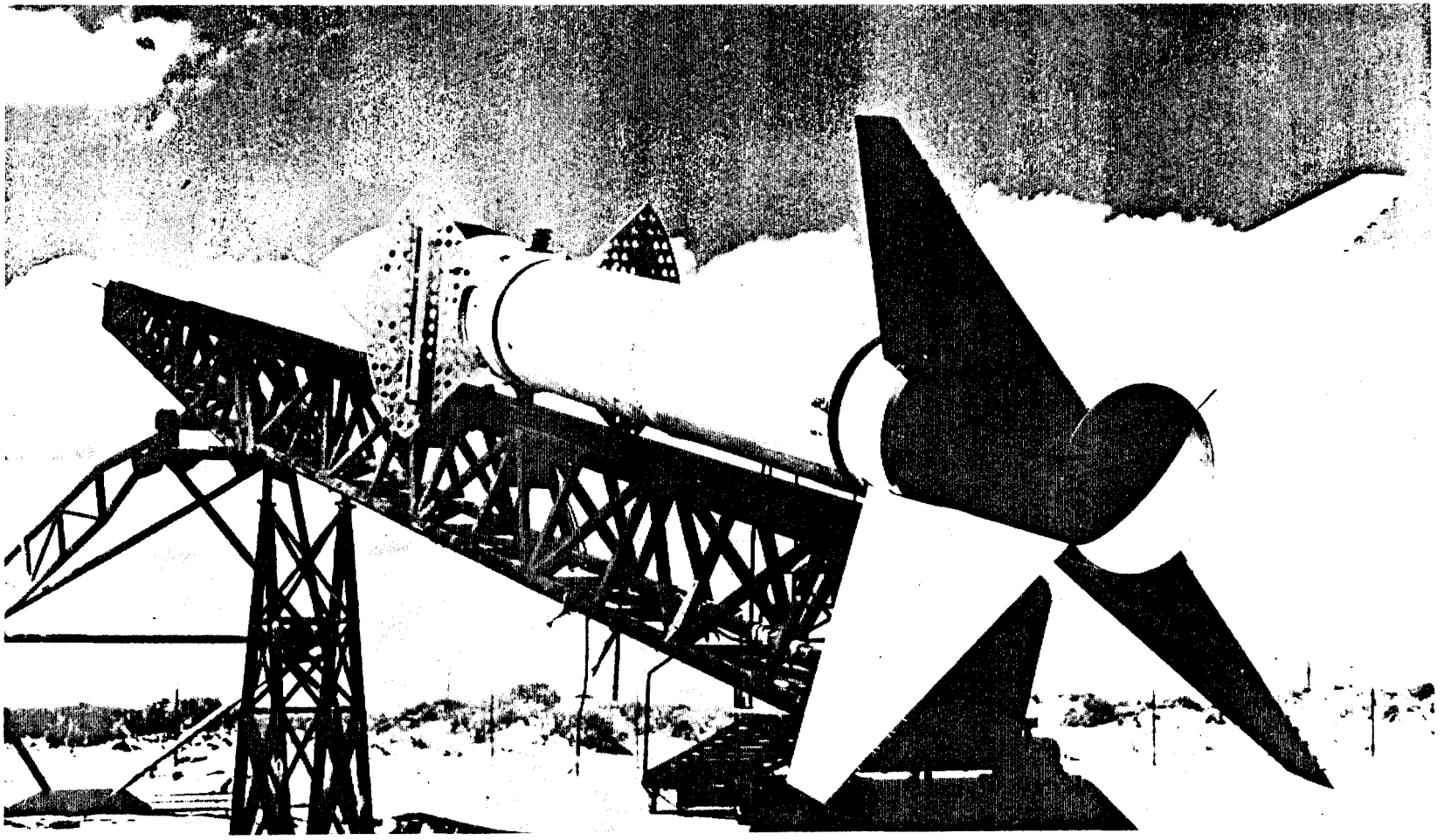
[47](1) DAC Tech Memo MTM-460, 16 May 52, sub: Considerations Concerning the Adaptation of Honest John Model 1236F to Short Range Use, pp. 1, 4. RSIC. (2) Memo, Chf, Rkt Dev Div, RSA, to Chf, Purch Asgmt Bd, 20 Mar 53, sub: Ord Proj TU2-1029 - Range Reduction Study, HJ. HJ R&D Case Files, Box 14-8, RHA AMSC.

[48](1) Memo, Chf, ORDTU, to Maj Gen L. E. Simon, 12 Nov 53, sub: Rept of Activities HJ Rkt. ORDTU File, Oct - Dec 53, MRB GSA FRC. (2) Memo, same to same, 16 Feb 54, sub: Rept of Activities Short Range HJ Rkt - Demijohn. ORDTU File, Jan - Feb 54, MRB GSA FRC.

[49]The cost of the spoiler kit, as a production item, was estimated at $150.00 each; the R&D cost to fully proof the Demijohn configuration, based on the firing of 10 additional rounds, was estimated at $200,000.

[50](1) DF, CofOrd to ACofS, G-4, 13 Apr 54, sub: 762-mm. Arty Rkt, Demijohn. (2) Ltr, ACofS, G-4, to OCAFF, 30 Apr 54, sub: Demijohn. Both in ORDTU File, Mar - May 54, MRB GSA FRC.



DJ I ON LAUNCHER

U. S. ARMY ORDNANCE PHOTO

WHITE SANDS PROVING GROUND

23 OCT 53

could be achieved by judicious reduction of Honest John firing positions, but conceded that the proposed modifications appeared to offer an easier solution to the problem. The use of spoilers, he said, "may be limited to special critical tactical situations arising infrequently," but their low cost "justifies their availability for such contingencies." Accordingly, he recommended that sufficient rounds be fired to proof the Demijohn configuration fully.[51]

(U) By the end of June 1954, the requirement for the Demijohn had been approved by the Army General Staff and instructions to expedite development and proof tests had filtered down to the Redstone Arsenal.[52] An eight-round flight test program (Demijohn Rounds 7 through 14) began at the White Sands Proving Ground in mid-February 1955 and continued through 19 August 1955. The results were unsatisfactory in several important respects. As one historian put it, the "spoilers lived up to their name too literally."[53] They not only affected the accuracy of the system, but also caused vibrations too severe for the warhead to withstand. Moreover, the Demijohn configuration failed to achieve the desired objective of effectively reducing the rocket's range to 5,000 yards. The Department of the Army finally decided to accept the narrower range of the standard Honest John, and the Demijohn program was abandoned.[54]

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[51] 1st Ind, OCAFF to ACofS, G-3, 10 May 54, on Ltr cited in footnote 50 (2) above.

[52] (1) DF, G-3 to G-4, 27 May 54, sub: Demijohn; and Cmt 2 thereto, G-4 to CofOrd, 11 Jun 54. (2) Ltr, CofOrd to CG, RSA, 22 Jun 54, sub: Demijohn - Proj TU2-1029, DA, Pri 1A. Both in ORDTU File, Jun - Aug 54, MRB GSA FRC.

[53] Eunice H. Brown, et al., "Development & Testing of Rockets & Missiles at White Sands Proving Ground, 1945 - 1955," (WSMR, 1 Oct 59), p. 165.

[54] (1) Ibid., p. 165. (2) Ltr, DAC to CG, RSA, 27 Mar 56, sub: Preliminary Evaluation of the Eight Rd Feas Prog for the Short Range Capability HJ (Demijohn) Rkt. ORDTU File, TU2-1029 - Demijohn, MRB GSA FRC. (3) OCM 37143, 6 Aug 59. RSIC.

(U) The Honest John Industrial Program, 1954 - 1960 (U)

(U) Background (U)

(U) Industrial participation in the Honest John project actually began in August 1951, when the Secretary of the Army placed the program on a crash or telescoped basis. At that time, the program was yet in the very early stages of research and development; but early industrial planning was necessary to anticipate and alleviate potential bottlenecks, so that initial production could start in the immediate future and proceed with minimum difficulties. The object, of course, was to compress the R&D-production schedules into a parallel effort and thereby provide a tactically useful weapon at an earlier date. This telescoped portion of the rocket program covered the period 1951 - 53.[55]

(U) Late in December 1951, it will be recalled, the Army Chief of Staff had approved a tentative program for FY 1952 that finally resulted in only a limited industrial procurement of 203 rounds. In November 1952, the Redstone Arsenal had proceeded to implement the approved FY 1953 plan for volume procurement of 2,000 rockets. This plan the Chief of Ordnance had reduced to 200 rounds to permit a series of special accuracy tests before the final design release of the rocket. The 403 Honest John rockets that were thus procured during FY 1952 - 53 had been used for firing tests and for training and equipping the first eight reduced-strength batteries for deployment.

(U) FY-1954 Industrial Procurement (U)

(U) The FY 1954 plan called for the procurement of 1,800 rockets which were to be reserved for stockpile and tactical use. The approved plan was basically the same as that previously adopted for the original 2,000-round program in 1953. It provided for the soliciting of proposals from competent firms on the basis of furnishing complete rounds or components only. All proposals for both procurement methods would be evaluated at the same time and the method more advantageous to the

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[55] See above pp. 54 - 65.

Government would be selected. In evaluating the proposals from prospective contractors, primary consideration would be given to such criteria as R&D experience, available design data, additional source of supply, and potential mass production capabilities.

(U) In November 1953, the Redstone Arsenal Industrial Division approached some 33 industrial sources and later received 25 proposals, including one from the Douglas Aircraft Company. The evaluation committee recommended that 900 rockets be procured from the Douglas Aircraft Company and 900 from the Emerson Electric Manufacturing Company, both on a prime contractor basis. By using this procurement method, the R&D experience of the rocket developer would be retained in the program and a second source of supply would be introduced, thereby providing a broader production base for future mass production. In addition, the prime contractor concept would simplify administration and control of the activity.[56]

(U) The ACofS, G-4, approved the committee's recommendations early in January 1954; but final contract negotiations were temporarily stalled by a legal dispute between the Government and the Douglas Aircraft Company. On 16 November 1953—the day set for the Redstone Arsenal to open competitive bids on the 1,800-round production order—Mr. Wheaton of Douglas Aircraft had called the Chief of Ordnance to advise him of a "bombshell" (teletype) he (Wheaton) had sent to the Arsenal. The message stated, in essence, that Douglas Aircraft had never granted, nor did it intend to grant to the Army the right to pass on to other contractors the contents of drawings and specifications generated by the company under Honest John contracts. Based on the findings of a cursory legal review, General Cummings decided to proceed with procurement, as planned, and to discuss the matter of proprietary rights with Douglas representatives "with a view toward getting more information, but not to slow down

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[56] (1) HJ Blue Book, pp. 63 - 64. (2) Chronology of the HJ Missile System, p. IV-16.

processing [the] award."[57] Accordingly, the Redstone Arsenal proceeded with negotiations with the Emerson Electric Manufacturing Company and awarded the contract for the first 900 rockets on 22 January 1954.[58]

(~~FOUO~~) Representatives of the Douglas Aircraft Company attended a conference in the Office, Chief of Ordnance, on 2 February 1954, at which time the Legal Counsel to the latter clearly enunciated the rights of the Government relative to the use of drawings, as spelled out in the contracts. At the close of the conference, Douglas' representatives gave the impression of complete agreement and it appeared that the dispute had been settled. But within a month it became apparent that this was not the case.[59]

(~~FOUO~~) In a last-ditch effort to block the duplication and release of drawings to other contractors, the senior vice president of Douglas Aircraft issued an internal policy memorandum requiring that all (military and civilian) engineering drawings originating within Douglas carry a statement as follows:

> "This drawing may be duplicated for use in inspection, maintenance and other internal operations, but the information contained hereon is not to be used in the procurement of any article shown hereon except from the Douglas Aircraft Company."

Company personnel lost no time in implementing the new policy, and by 10 March 1954, the Redstone Ordnance Officer in the Los Angeles Area had received a bunch of drawings which he could neither approve nor process

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[57] (1) MFR, Lt Col James P. Hamill, 16 Nov 53. ORDTU File, Oct - Dec 53, MRB GSA FRC. (2) The Ordnance Corps had already experienced similar trouble with both Douglas Aircraft (see pp. 54 - 55, 60), and the M. W. Kellogg Company (see pp. 70 - 71).

[58] HJ Blue Book, p. 155. (Contract DA-23-072-ORD-793, for $5,255,465; delivery period, August 1954 - February 1956.)

[59] Ltr, 00/4U0-13646, CofOrd to CG, RSA, 31 Mar 54, sub: Addition of Proprietary Rights Clause to Ord Drawings. ORDTU File, Mar - May 54, MRB GSA FRC.

for competitive procurement bidding.[60] Such a flagrant violation of Ordnance standards and practices, as outlined in the contract, would surely undermine Army procurement plans, not only for the Honest John system, but also for the Nike Ajax and other high priority systems then being developed by Douglas. Moreover, if allowed to stand, it could set a dangerous precedent for other industries and eventually undermine the entire Army procurement structure.

(U) The Chief Counsel to the Chief of Ordnance took the position that full right, title, and interest in the design of the Honest John rocket rested in the Government, legally, morally, and equitably. Specifically, he held that the provisions of the R&D contract (ORD-22) and the production engineering study contract (ORD-328) granted to the Government either full title to the drawings produced and delivered thereunder, or, at a minimum, the right to use the same for any governmental purpose, including competitive procurement. In this view, he ruled that the Douglas Aircraft Company, in furnishing drawings marked with the restrictive statement indicated, was "in effect avoiding certain of their obligations under the contracts and consequently drawings so marked may not be accepted by the Government as complying with the contract terms, under which they are delivered."[61]

(U) The countermeasures recommended by the Chief Counsel, and quickly enacted by the Chief of Ordnance, were calculated to nullify the restrictive markings arbitrarily stamped on Ordnance drawings and to prohibit such practice in the future. The Chief of Ordnance directed that the Contracting Officer inform the Douglas Aircraft Company in

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[60] Ltr, Lt Col Cecil P. Rice, ROO, LAA, to CG, RSA, 10 Mar 54, sub: Addition of Proprietary Rights Clause to Ord Drawings, attached as Incl 1 to Memo, Chf, ORDTU, to Chf Counsel, Ord Corps, 19 Mar 54, same sub. ORDTU File, Mar - May 54, MRB GSA FRC.

[61] 1st Ind, J. H. Church, Chf, ORDGL-PT, to Chf, ORDTU, 25 Mar 54, on Memo, Chf, ORDTU, to Chf Counsel, Ord Corps, 19 Mar 54, sub: Addition of Proprietary Rights Clause to Ord Drawings. ORDTU File, Mar - May 54, MRB GSA FRC. (This document includes a similar legal opinion on the Government's rights to Nike drawings under Contract W-30-069-ORD-3182.)

writing that the restrictive legend stamped on Ordnance drawings violated the terms of the contract and therefore must be nullified by cancelling, or blocking out in reproduction of the drawings. He further directed that action be taken to acquaint Douglas with the error in this practice as measured by terms of the contract, and to require that all future drawings be delivered without restrictive markings. "It should be pointed out . . . that compliance . . . is required and that if restrictive markings of any kind appear on future drawings that appropriate administrative action by the Government may result . . . ."[62] The Douglas Aircraft Company acquiesced. The dispute was settled.

(U) On 2 April 1954, the Los Angeles Ordnance District awarded the Douglas Aircraft Company a contract for production of 900 rockets to complete the 1,800-round order for FY 1954.[63] Douglas Aircraft produced the airframe components and subcontracted M6 JATO metal parts to the Consolidated Western Steel Company. In like manner, the Emerson Electric Manufacturing Company subcontracted M6 JATO parts to the Alco Products, Inc. The Hercules Powder Company, Radford Arsenal, Virginia, loaded, assembled, and packed the M6 JATO units, while the Thiokol Corporation at Redstone Arsenal, Alabama, loaded the M7 (spin rocket) JATO's.

(U) Since the final drawings for rocket containers were not available at the time the Douglas and Emerson contracts were let, the Redstone Arsenal awarded separate contracts for production of this item—one to the St. Louis Car Company on 3 May; one to the Lyon Van & Storage Company on 9 June; and one to the Warlick Cabinet Company on 29 June 1954. Other industrial contracts awarded in 1954 included two to J. B. & R. E. Walker, Inc., for practice warheads.[64]

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[62] Ltr, 00/4UO-13646, to CG, RSA, 31 Mar 54, sub: Addition of Proprietary Rights Clause to Ord Drawings. ORDTU File, Mar - May 54, MRB GSA FRC. (Similar action was directed in connection with the Nike project.)

[63] HJ Blue Book, p. 155 (Contract DA-04-495-ORD-533, for $5,373,740; delivery period, April 1954 - March 1956).

[64] (1) Ibid., p. 155. (2) Chronology of the HJ Msl Sys, pp. IV-7, IV-16, 17.

[redacted]

(U) (U) Follow-On Procurement (U)

(U) Follow-on procurement of M31 rockets (less warhead) continued through FY 1958, with production deliveries extending through the middle of FY 1961. With a few minor exceptions, the procurement procedures and policies remained unchanged. The accompanying map shows the geographic location of prime contractors, key subcontractors, and Government-owned loading plants participating in the 1955 - 56 procurement program. The flow charts on the ensuing pages reflect the contract structure as it appeared in the last procurement year (FY 1958).

(U) From the beginning of industrial procurement, in 1952, through December 1960, a grand total of 7,799 M31 rockets were produced and delivered in the Basic Honest John Program. Of these, 5,023 were allocated to U. S. Army units, and the remaining 2,776 to the North Atlantic Treaty Organization under the Military Assistance Program.[65]

(U) Concurrently with the phase-out of M31 rocket motor production, in December 1960, the Radford Arsenal converted its propellant manufacturing and loading facilities to the production of XM31E3 motors for the Improved (XM50) Honest John Rocket. Production contracts for the first increment buy of the improved system had been signed with Emerson Electric and Douglas Aircraft about the middle of FY 1960. The original schedule had called for initial XM50 deliveries to begin in January 1961, immediately following the final M31 production lot; however, because of technical difficulties with the motor, the first units did not become available until May 1961—some 5 months after delivery of the last M31 unit.[66]

(U) Between FY 1956 and 1959, 2,280 M6 (T2043E1) HE Warhead sections were procured for U. S. Army units. Production of the interchangeable

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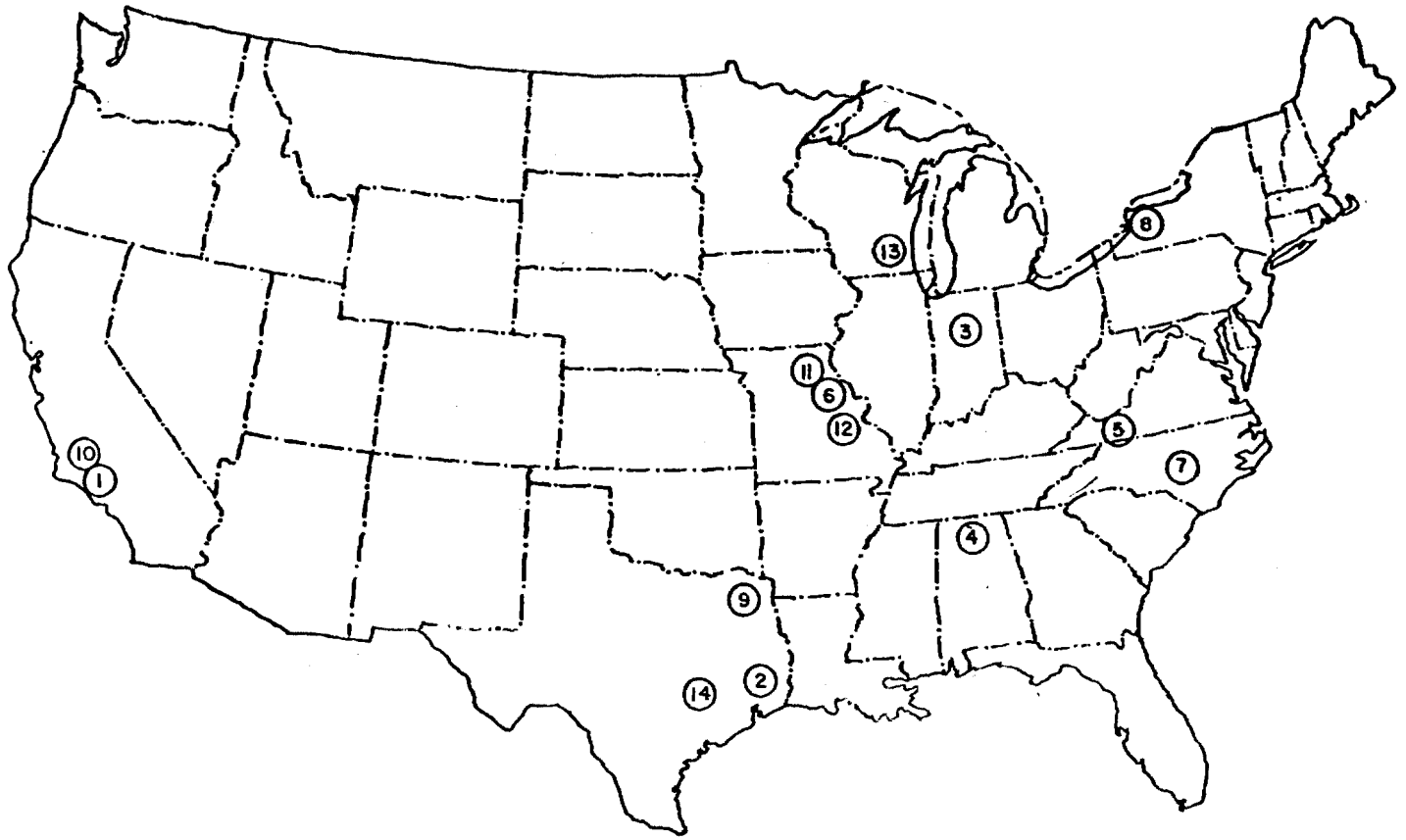
[65] "The Army Materiel Plan (U) - FY 1963 - 70," Vol III - Missile Systems (RCS CSGLD-1138), Feb 64, p. 227 (HJ - Jan 64 Draft). Plans Div Files, Compt & Dir of Programs, AMICOM.

[66] HJ Progress Repts: Dec 59, p. 11; Dec 60, pp. 2 - 4; Apr 61, p. 4; May 61, p. 4.

[redacted]



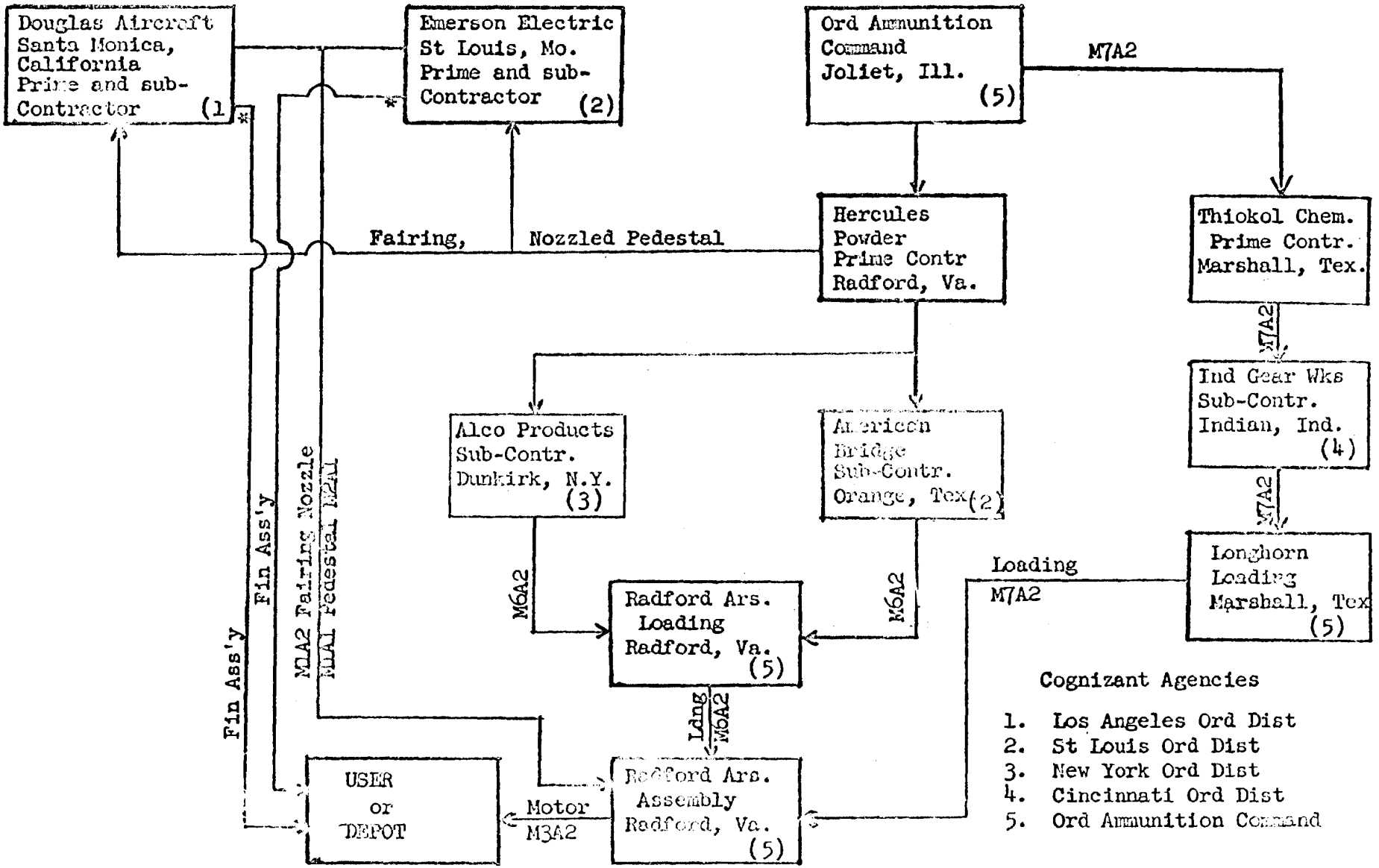
1. DOUGLAS AIRCRAFT CO., SANTA MONICA, CAL.
2. AMERICAN BRIDGE CO., (CONSOLIDATED WESTERN STEEL) ORANGE, TEXAS
3. PACKARD MFG. CO., INDIANAPOLIS, IND.
4. THIKOL CHEMICAL CO., REDSTONE ARSENAL, HUNTSVILLE, ALA.
5. RADFORD ARSENAL (HERCULES POWDER CO.) RADFORD, VA.
6. EMERSON ELECTRIC MFG. CO., ST. LOUIS, MO.
7. SACO-LOWELL SHOPS, SANFORD, N.C.
8. ALCO PRODUCTS CO., DUNKIRK, N.Y.
9. LONGHORN ORDNANCE WORKS, MARSHALL, TEXAS
10. LYON VAN & STORAGE CO., BURBANK, CAL.
11. ST LOUIS CAR CO., ST LOUIS, MO.
12. NORDBERG MFG. CO., ST. LOUIS, MO.
13. LADDISH CO., CUDAHY, WIS.
14. CAMERON IRON WORKS, INC., HOUSTON, TEXAS

ROCKET, 762 MM, M31A1 (HONEST JOHN)
CONTRACTORS (PRIME & MAJOR SUB-CONTRACTORS) & LOADING PLANTS

Rocket, 762MM, M31A1 (HONEST JOHN)
Contractors (Prime & Major Sub-Contractors) & Loading Plants

CONTRACT STRUCTURE

HONEST JOHN Rocket 762-T4 w/o Warhead FY 58



* Prime contractor for Fin, Sub-Contractor for Fairing, Nozzle and pedestal.

M144 (T2044E1) HE Warhead (designed for use with both the M31 and XM50 rockets) began in FY 1959. At the end of FY 1962, a total of 2,265 M144 heads had been procured for U. S. Army units and 144 for the U. S. Marine Corps.[67]

(U) Production of the XM4 Flash-Smoke Practice Head began in FY 1957 and continued through FY 1959, with procurement totaling 1,267 (173 XM4E1's; 512 XM4E3's; and 582 XM4E4's). Of these, 787 were procured for U. S. Army units, 64 for Marine Corps units, and the remaining 416 for customers under the Military Assistance Program. The interchangeable M38 Flash-Smoke Head was phased into production in FY 1960. Procurement of the M38 head, through FY 1961, totaled 1,049—303 for Army units, 20 for the Marine Corps, and 726 for customers under the Military Assistance Program.[68]

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[67] Army Materiel Plan, Aug 63, p. 275. HJ/LJ Commodity Ofc Files.

[68] (1) Ibid., p. 279. (2) OCM 37411, 26 May 60. RSIC.

CHAPTER VI

(U) DEVELOPMENT AND PRODUCTION OF THE SELF-PROPELLED LAUNCHER (U)

(U) The rail-type launching system developed for the Honest John rocket marked a definite turning point in the evolution of weaponry. During the early postwar period, primary emphasis had been focused on the development of multiple, cluster-type launchers, mainly in the 4.5-inch caliber. This emphasis continued until 1951, when the Field Forces established a requirement for a large-caliber, rail-type launching system for the Honest John rocket. The 762-mm. caliber of the Honest John was more than double that of the huge 280-mm. Atomic Cannon, which was then under development. Even when emplaced without its transporters, the atomic cannon would be more than twice as heavy and much less maneuverable than the truck-mounted, rail-type system contemplated for the Honest John.[1]

(U) As a general rule, the development of ground equipment begins concurrently with the design and development of the missile, this being essential to meet master planning schedules for the complete weapon system. But in the case of the Honest John system, the development of ground equipment lagged behind the rocket effort by more than a year, placing the developing agency at a distinct disadvantage. Recognizing that many technical problems would be encountered in the development of this new rail-type launching system, the Commanding Officer of the Rock Island Arsenal had recommended that the design and development effort be conducted concurrently with the rocket program. However, the Chief of Ordnance decided that the launcher phase of the program should be held in abeyance pending completion of the feasibility demonstration firings and a decision on the acceptance of the Honest John as a tactical

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[1] Niel M. Johnson and Leonard C. Weston, "Development and Production of Rocket Launchers at Rock Island Arsenal, 1945 - 1959," (2 vols., August 1962), II, 287.

weapon.[2] When the launcher feasibility studies finally commenced in late August 1951, the entire Honest John program had been placed on a crash basis, further compressing the development time scale.

(U) Feasibility Study Program (U)

(U) The Rock Island Arsenal, the Redstone Arsenal, and the Douglas Aircraft Company began parallel design studies, in August 1951, to evolve preliminary and basic concepts of a tactical launcher for the Honest John rocket.[3] These early studies, conducted under Ordnance Project TU2-1029, were based on experience gained in the initial phase of rocket development and, to a lesser extent, on the following tentative characteristics established in early August.

> The launcher should be easy to assemble in the field and require the minimum of special equipment. Special transporting equipment, if required, shall be towed by standard vehicles. Equipment shall be constructed to permit air transportability. The launcher for field testing will be fabricated as a fixed installation but with elevation adjustments for firing. The launcher will be designed to give minimum of tip-off to the rocket in launching.[4]

(U) During a conference held at the Office, Chief of Ordnance, on 18 September 1951, representatives of the three study agencies presented their respective launcher proposals for evaluation by officials of the Army Field Forces. The Douglas Aircraft Company and the Rock Island Arsenal each submitted two similar launcher designs: a knocked-down portable type and a semitrailer type.[5] Using the technical data and knowledge accumulated in earlier feasibility studies,[6] Redstone's design

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[2] 1st Ind, 00 471.94/239, CofOrd to CO, RSA, 4 May 51, on Ltr, CO, RIA, to CofOrd, sub: Lchr for Rkt Model 1236F. ORDTU File, Jul 50 - May 51, MRB GSA FRC.

[3] (1) TT ORD-18389, CofOrd to CO, RIA, et al., 24 Aug 51. HJ R&D Case Files, Box 14-90, RHA AMSC. (2) Mary T. Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," (2 vols. and supplement, RSA, 1 July 1954), II, 220.

[4] OCM 33836, 2 Aug 51. RSIC.

[5] Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," II, 220 - 21.

[6] See above, pp. 19 ff.

engineers came up with a comprehensive proposal consisting of four basic launcher types, all falling within the size and weight limitations which had been set up by the draft agreement of the Combined Conference on Artillery, held at Fort Monroe, Virginia, on 17 - 24 March 1949. These included Type I, a self-propelled, vehicle-mounted launcher; Type II, a full or semitrailer-mounted launcher; Type III, a ground-emplaced, trailer transport launcher; and Type IV, a ground-emplaced, air transport launcher.[7]

(U) Officials of the Army Field Forces agreed to evaluate the proposed launcher designs and recommend one or more for development. At the same time, the Chief of Ordnance assigned to the Rock Island Arsenal the responsibility for technical supervision of the launcher development program; whereas the Redstone Arsenal was to coordinate the activities and requirements of both the rocket and launcher programs.[8]

(U) In October 1951, the Chief, Army Field Forces, notified the ACofS, G-4, that the Redstone Arsenal Type I and Type II launchers had been selected as the first and second choices for development, and the Douglas Aircraft Company's trailer-type launcher as the third choice. However, in the interest of economy of funds and development effort, he suggested that only one of these launchers be developed. The one showing the greatest promise of initial success and therefore recommended for development was the Arsenal's self-propelled, truck-mounted launcher (Type I).[9]

(U) Pursuant to recommendations and requirements outlined by the Army Field Forces, the ACofS, G-4, directed the Chief of Ordnance to proceed immediately as follows:

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[7] RSA Rept No. T-3-a, 14 Sep 51, sub: Tactical Type Launchers for the Honest John Rocket. RSIC.

[8] Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," II, 221.

[9] Ltr, OCAFF, to ACofS, G-4, 18 Oct 51, sub: Lchg & Hdlg Equip. ORDTU File, Sep 51 - Nov 51, MRB GSA FRC.

a. Develop on a standard truck chassis a self-propelled launcher similar to the Redstone Type I. . . .

b. Develop a missile transport vehicle capable of carrying at least two (2) 1236F Rockets. A suitable modified standard truck with appropriate cradles is suggested. This vehicle must have equal cross-country mobility to the launcher.

c. Provide a suitable standard truck-mounted crane to permit transfer of the 1236F Rockets from the transporter . . . to the emplaced self-propelled launcher . . . . The mobility of this crane must be equal to or better than that of the launcher and rocket transporter.

d. Schedule the development and procurement of the items listed . . . above so as to have all three (3) available for engineering and service test at the earliest practical date.[10]

In passing these instructions on to the Rock Island Arsenal, in November 1951, Colonel Toftoy explained that the Army Field Forces had promised to furnish detailed military characteristics on the launcher by 15 December, and had given "informal assurance" that there would be no major changes from the characteristics compiled during the 18 September conference.[11]

(U) Formal Development Program Established

(U) The development of tactical ground equipment for the Honest John rocket officially began with the establishment of Ordnance Project TU2-3008 in late November 1951, almost 3 months after the rocket program had been placed on a crash basis. The scope of work stated in the formal program was essentially the same as that directed by G-4 early in November. The initial schedule called for completion of R&D work by April 1952 and operational evaluation by January 1953. Early fiscal estimates amounted to $150,000 for FY 1952 and $80,000 for FY 1953.[12]

(U) The "proposed" statement of detailed military characteristics from the Army Field Forces became available in February 1952—nearly

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[10] DF, G4/F4 64900, Asst Dep ACofS, G-4 for Special Weapons, to CofOrd, 8 Nov 51, sub: Lchg & Hdlg Equip for HJ. ORDTU File, Sep 51 - Nov 51, MRB GSA FRC.

[11] Ltr, 00 471.94/758, CofOrd to CO, RIA, 13 Nov 51, sub: Lchg & Hdlg Equip for HJ, Proj TU2-1029, Pri 1A. HJ R&D Case Files, Box 14-90, RHA AMSC.

[12] OCM 34118, 28 Feb 52. RSIC.

2 months later than promised.[13] But the Ordnance Technical Committee did not approve and publish the official statement of military requirements until 20 November 1952; and the Army General Staff withheld final approval until February 1953.[14] By that time, sharp differences of opinion had arisen over the type of tactical ground equipment required, and the scope of work under Project TU2-3008 had been expanded far beyond that originally authorized.

(U) Tactical Doctrine and Equipment (U)

(U) To fulfill its intended field artillery mission, the Honest John battalion would have to be equipped with rugged, highly mobile launchers and associated handling gear which would be simple to operate and maintain under combat conditions. Since Honest John units would present a great atomic threat to a hostile force, they were certain to be prime enemy targets. Moreover, the Honest John rocket would be fired from forward positions, easily detected by the enemy, in contrast to the long-range missiles emplaced well to the rear. Hence, the ability to go into position, fire, and quickly move out—commonly known as the "shoot and scoot" artillery tactic—was a matter of vital importance.

(U) If there was universal agreement on the fundamental mission of the Honest John system, there was also universal disagreement on the precise type of ground equipment required, as well as the tactical usage of "Stockpile to Target Sequence" of such equipment. The gross lack of firm and timely user decisions, coupled with the absence of master planning schedules for effective coordination of the multilateral program, created a damaging atmosphere of frustration and confusion which materially delayed the development and delivery of acceptable equipment and

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[13] Ltr, ATDEV-10 471.94/300, OCAFF to ACofS, G-4, 12 Feb 52, sub: Proposed MC's for a Large Cal Sp Purpose Fld Rkt, w/Lchr, Fire Control & Ammo Hdlg & Loading Equip; w/Incl, "Proposed Military Characteristics..., Project No. FA 3851," 8 Feb 52. ORDTU File, Mar 52 - Apr 52, MRB GSA FRC. (NOTE: Copies of letter and inclosure were sent directly to interested agencies, including the Chief of Ordnance and the Rock Island Arsenal.)

[14] OCM 34490, 20 Nov 52; OCM 34615, 12 Feb 53. RSIC.

increased the overall program costs. Allowed to go uncorrected, these conditions ultimately interfered with the personnel training program and prevented the Ordnance Corps from providing effective and continuous field support to the initial Honest John rocket batteries. For example, the Chief of Ordnance, as late as May 1954, was still pressing "for a very early decision as to the final organization of the artillery rocket batteries . . ." and for immediate steps to train sufficient personnel "to adequately support the . . . batteries scheduled for overseas deployment. . . ."[15]

(U) The launcher controversy took shape in early January 1952, when General Collins, the Army Chief of Staff, expressed disagreement with the Army Field Forces' selection of the self-propelled launcher, indicating that the trailer-mounted launcher would be more feasible. When advised of this dissenting opinion, a staff officer of the Army Field Forces stated that his office "had not been contacted in this regard but as a result of thorough investigation the field forces had recommended the self-propelled [launcher] for primary development for tactical use." He was equally definite in the Field Forces' interpretation of a self-propelled mount, in that a "semitrailer" type could not be construed as being self-propelled.[16]

(U) Yet, the proposed statement of military characteristics, submitted by the Army Field Forces less than a month later, in February 1952, stated that the "launcher may be self-propelled or towed."[17]

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[15](1) MFR, Lt Col A. L. Stevens, OCO-ORDTU, 11 May 54, sub: Ord Spt of Fld Arty Rkt Btrys (HJ). ORDTU File, Mar 54 - May 54, MRB GSA FRC. (2) Also see Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," II, 152.

[16]MFR, Lt Col W. C. Ohl, OCO-ORDTU, 2 Jan 52 (handwritten notes on discussion with Col Fletter, OCAFF). ORDTU File, Dec 51 - Feb 52, MRB GSA FRC.

[17]"Proposed Military Characteristics for a Large Caliber Special Purpose Field Rocket, with Launcher, Fire Control and Ammunition Handling and Loading Equipment, Project No. FA 3851," 8 Feb 52, Incl to Ltr, ATDEV-10 471.94/300, OCAFF to ACofS, G-4, 12 Feb 52, sub: Proposed MC's for a Large Cal Sp Purpose Fld Rkt ... ORDTU File, Mar - Apr 52, MRB GSA FRC.

Taken at its face value, this statement implied that the Field Forces had decided to leave the launcher decision up to the Ordnance Corps, and further, that either a self-propelled, truck-mounted launcher, or a towed, trailer-mounted launcher would be acceptable. But this was not the case. During a conference at the Rock Island Arsenal, on 20 February 1952, Lt. Col. W. C. Ohl, of the Rocket Branch, OCO, emphasized that the Army Field Forces were still "firm in their first choice of the self-propelled launcher," and that their "second choice was the trailer-mounted launcher."[18] In other words, the Ordnance Corps could develop the towed, trailer-mounted type if it liked, but the self-propelled type must be given first priority.

(U) Nevertheless, it was the general consensus among Ordnance Corps personnel that the trailer-mounted launcher would be more feasible than the self-propelled type. Influencing this opinion was the requirement for a transport vehicle capable of carrying two rockets (in addition to the one carried on the self-propelled launcher), plus equipment for transferring the rockets to the launcher at the launching site. The disclosure of the launch position after firing the first rocket, together with the time required to load subsequent rockets onto the launcher, clearly indicated that this system would have questionable value under combat conditions. With the trailer-mounted type, several trailers with rockets in place could be towed to the desired position and the rockets fired in quick order. The principal objection to this system was that a prime mover would have to be supplied with each trailer if immediate removal from the launching site were desirable. On the other hand, it would eliminate the need for the missile transport vehicle and the rocket-handling crane, since the loading operation would take place in an assembly area well to the rear of the launching site.[19]

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[18] Tvl Rept, C. J. Koeper, 26 Feb 52, [HJ Lchr Conf at RIA]. HJ R&D Case Files, Box 14-8, RHA AMSC.

[19] Ibid.

(U) Ordnance representatives attending the February 1952 conference also questioned the feasibility of designing a transport vehicle with provisions for carrying two rockets plus the necessary rocket-handling equipment. Experience at the White Sands Proving Ground had shown that the use of a crane for mounting the rocket on the launcher ramp would not be satisfactory, especially under combat conditions. A rail-type transfer mechanism to mate with the aft end of the launcher rail would be more feasible; and this type of mechanism indicated that a one-rocket transport carrier would be both desirable and essential.

(U) From the foregoing discussions and conclusions came the following three significant decisions.

a. A self-propelled launcher similar to the Redstone Arsenal Type I will be developed. If time permits a parallel development of a trailer mounted type similar to the Redstone Arsenal Type II will be considered.

b. A transport carrier with provisions for carrying one rocket with the necessary transfer equipment will be developed. This vehicle may be towed by the self-propelled launcher or it may have its own prime mover.

c. A truck-mounted crane for transferring rockets from the tranport carrier to the launcher will not be provided.[20]

(U) The parallel program for developing a trailer-mounted launcher became a reality in April 1952 at the direction of General Collins, who again emphasized the need for this type of launcher during a visit to the White Sands Proving Ground.[21] Conducted on a noninterference basis with the self-propelled launcher project, this effort actually consisted of two engineering programs on different types of trailer-mounted launchers. A study by the Douglas Aircraft Company culminated in the fabrication and delivery, in May 1953, of one semitrailer-type launcher, designated as the XM-290. A year later, the Ordnance Corps withdrew the

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[20] Ibid. (For the full extent of changes effected within a period of slightly more than 3 months, compare the above items with those quoted on page 144.)

[21] Ltr, OO 471.9/1811, CofOrd to CO, RSA, 14 Apr 52, sub: Lchr for HJ Rkt, Proj IU2-3008, DA Pri 1A. HJ R&D Case Files, Box 14-90, RHA AMSC.

requirement for a trailer-type launcher and thus cancelled the program after spending more than $270,000.[22] The American Machine & Foundry Company conducted an engineering study on an alternate, full-trailer approach; however, the proposed design was not acceptable to the Field Forces and the Chief of Ordnance cancelled the contract, in November 1953, after a net expenditure of $22,266.[23]

(U) From the outset, the Ordnance Corps realized that at least a tentative tactical employment plan would be required early in the development phase inasmuch as the tactical use of a weapon system such as the Honest John could have a profound influence upon weapon design. The Field Forces, however, appeared reluctant to commit themselves to a final and complete operational concept and were thus inclined to render piecemeal decisions as specific questions arose. Using fragmentary data collected through late July 1952, engineers of the Redstone Arsenal Rocket Development Group prepared an analysis of the required launching and handling equipment, based upon the tactical concept as understood at that time. Six months later, they still had received no official correspondence outlining the entire concept of tactical operation, and therefore were still using their own unofficial assumptions as guidelines.[24]

(U) Further complicating an already untenable situation at lower management levels was a definite lack of unanimity among officials of the Army Field Forces and the Army General Staff. A prime example of this was the controversy over the type of tactical launcher required, the basic differences here obviously stemming from opposing ideas on tactical employment of the system. These differences also became

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[22](1) Monthly Prog Rept, Proj TU2-3008, May 53. HJ R&D Case Files, Box 14-8, RHA AMSC. (2) RAD Order ORDTU 2-1995, 26 Mar 52. ORDTU File, Mar 52 - Apr 52, MRB GSA FRC.

[23](1) Qtrly Prog Rept, Proj TU2-3008, Sep - Nov 53. HJ R&D Case Files, Box 14-8, RHA AMSC. (2) HJ Blue Book, p. 155. (3) For details on these and other supplemental programs, see below, pp. 201 - 14.

[24]Memo, Fred B. Smith, Dep Chf, Rkt Dev Gp, to Dir, Ordnance Missile Laboratories (OML), 8 Dec 52, sub: Ord Proj TU2-1029 - HJ - Tech Supervision. HJ R&D Case Files, Box 14-9, RHA AMSC.

apparent in some of the piecemeal decisions on the ancillary equipment necessary for assembling and handling the rocket.

(U) A case in point occurred on 1 May 1952, during the regular meeting of the Honest John Launcher Panel at the Rock Island Arsenal. In the course of this meeting, Maj. Nelson W. Tobey, representing the Army Field Forces Board No. 1, announced certain conclusions relative to the "assembly to target" procedure, which he said had been approved during an earlier conference in the Office of the Chief, Army Field Forces. These approved conclusions resulted in certain changes to the proposed military requirements released less than 3 months earlier and thereby affected the direction of design work being conducted under an extremely tight schedule. More importantly, the Field Forces' operational doctrine differed materially from that approved by the ACofS, G-4, during a meeting of the Honest John Ad Hoc Fuze Committee on 25 March 1952.[25]

(U) Among the principal questions was whether depot assembly conditions would be required for the rocket, or whether mobile units would be required for assembly operations 3 to 12 miles behind the lines. In addition, the Army Field Forces concluded that the "firing of more than one Honest John rocket from a single launcher and launching site in a short period of time will be the exception rather than the rule," and further indicated that selected and prepared firing sites only would be used.[26] This statement, of course, was tantamount to the automatic elimination of the rocket transporter-loader vehicle and the introduction of a possible requirement for comparatively immobile equipment such as bulldozers. Referring to these sharply defined conflicts, the Assistant Chief of Ordnance advised the Director of Logistics, in mid-May 1952, that the development program had reached the point where

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[25](1) Tvl Rept, C. J. Koeper, 8 May 52, [HJ Lchr Panel Mtg, RIA, 1 May 52]. HJ R&D Case Files, Box 14-8, RHA AMSC. (2) DF Cmt 2, ACofOrd to ACofS, G-4, 12 May 52, sub: Svc Test Rqrmts for HJ & Ancillary Equip. ORDTU File, May 52, MRB GSA FRC.

[26]Tvl Rept, C. J. Koeper, 8 May 52 [HJ Lchr Panel Mtg, RIA, 1 May 52].

"operational doctrine must be clarified." To avoid delay in the program and assure delivery of prototype ground equipment by the August 1952 target date, he urged that a definite procedure for tactical employment of the rocket be made available at an early date.[27]

(U) Colonel Ohl outlined the approved tactical employment concept for the Honest John rocket during the regular launcher panel meeting at the Rock Island Arsenal on 2 June 1952. Briefly, the tactical units would be serviced by three storage or supply depots: (1) the Very Heavy Artillery Supply Unit, (2) the Ordnance Supply Depot, and (3) the Chemical Supply Depot. These depots would be located from 20 to 100 miles from the Battery Assembly Area; the latter would be strategically located from 3 to 12 miles from the launching site. Each battery would have nine launchers, six emplaced and three floating. The required head-ogive assemblies, motors, fins, etc., would be transported to the Battery Assembly Area and assembled. The fully assembled rocket would then be placed on the launcher and transported to the launching site. Cranes would be available in the assembly area for loading the rocket onto the launcher. One trailer would be supplied for each battery of nine launchers. It could be designed to accommodate two motors with detached fins, or one fully assembled rocket. The trailer could also be used for carrying standard heads from the Ordnance Supply Depot.[28]

(U) Launcher Development and Delivery Schedules

(U) The development program originally established under Ordnance Project TU2-3008 called for the design and manufacture of one complete set of ground equipment, including a pilot model of the self-propelled launcher, the missile transport vehicle, and associated handling equipment. Excluding the standard vehicles which were to be furnished

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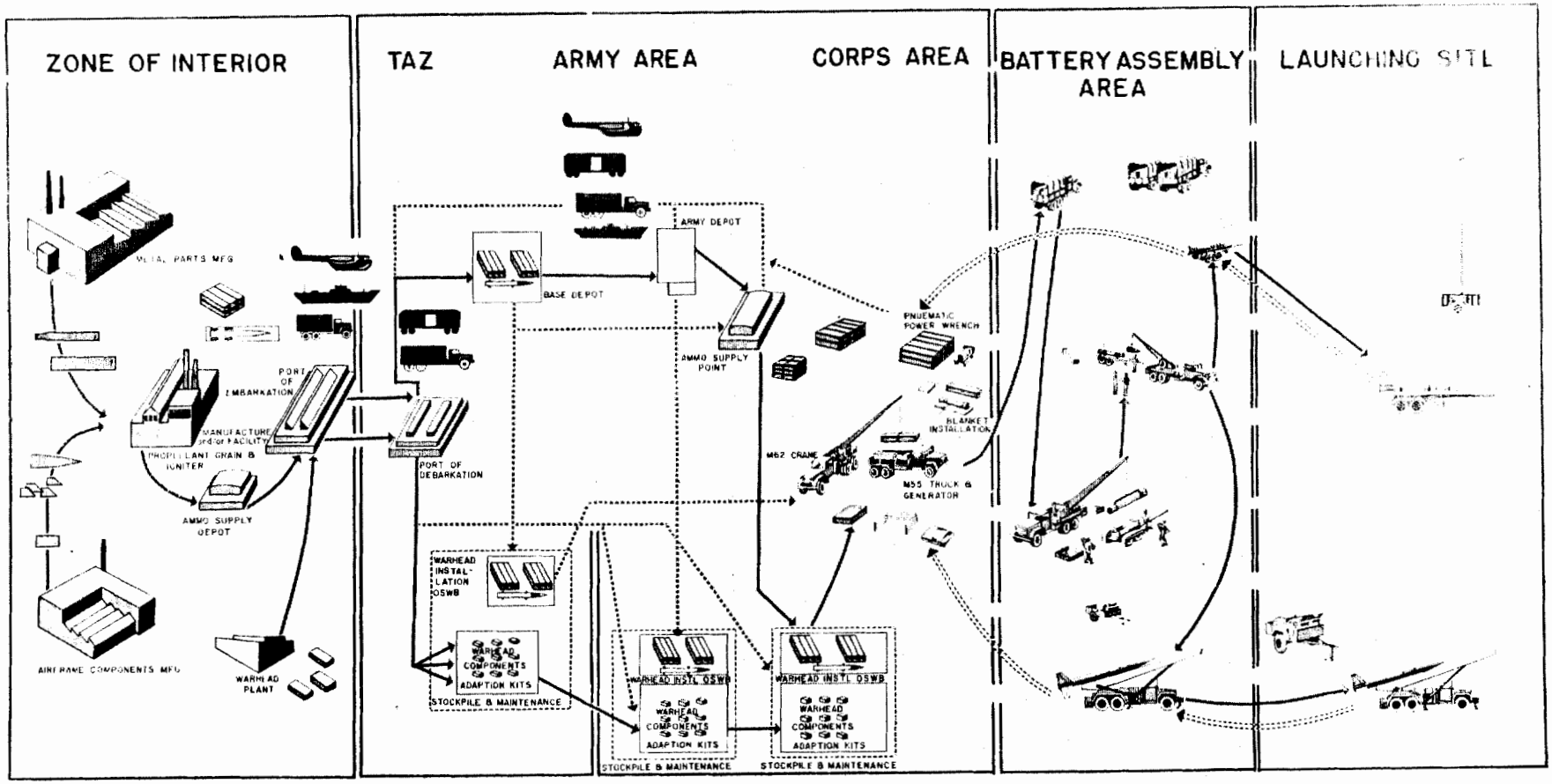
[27] DF Cmt 2, ACofOrd to ACofS, G-4, 12 May 52, sub: Svc Test Rqrmts for HJ and Ancillary Equip. ORDTU File, May 52, MRB GSA FRC.

[28] (1) Tvl Rept, C. J. Koeper, 10 Jun 52, [HJ Lchr Panel Mtg, RIA, 2 Jun 52]. HJ R&D Case Files, Box 14-8, RHA AMSC. (2) The "Stockpile to Target Sequence," as finally established, is illustrated in the accompanying chart.

HONEST JOHN STOCKPILE TO TARGET SEQUENCE



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free-issue, the Rock Island Arsenal first estimated, in November 1951, that the initial pilot set could be designed and constructed for $132,000.[29] However, this original cost estimate turned out to be as unrealistic as the scheduled delivery date of July 1952.

(U) The delay in establishing a formal development program for Honest John ground equipment, coupled with the failure of the user to provide timely guidance on technical requirements, placed the Rock Island Arsenal at a definite disadvantage. When the development of launching and handling equipment finally began in November 1951, the rocket portion of the program had been in progress well over a year, and the delivery of rockets for engineering-user tests had been scheduled for June 1952. This left the Rock Island Arsenal only 7 months in which to design, manufacture, and deliver the first pilot set of ground equipment. Yet, the proposed military characteristics for such equipment did not become available until February 1952, and a portion of these stated requirements was subsequently changed. This situation notwithstanding, the Assistant Chief of Ordnance notified the Rock Island Arsenal, in early January 1952, that testing of the launcher at the White Sands Proving Ground was scheduled to begin in July 1952, and insisted that the development effort be expedited to meet this target date.[30]

(U) During a conference held at the Rock Island Arsenal on 20 February 1952, Arsenal representatives agreed that development would proceed at an accelerated rate; but even so, the delivery of equipment could not be promised until July.[31] Since several weeks would be required for preliminary static tests, the initial flight testing possibly would be delayed until August. This potential delay in the program

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[29] Ltr, CO, RIA, to CofOrd, 23 Nov 51, sub: Lchg & Hdlg Equip for HJ Proj TU2-1029. HJ R&D Case Files, Box 14-9, RHA AMSC.

[30] Ltr, ACofOrd to CO, RIA, 9 Jan 52, sub: HJ Lchr - Proj TU2-3008, DA Pri 1A. HJ R&D Case Files, Box 14-9, RHA AMSC.

[31] Tvl Rept, C. J. Koeper, 26 Feb 52, [HJ Lchr Conf at RIA]. HJ R&D Case Files, Box 14-8, RHA AMSC.

prompted the Chief of Ordnance to set up a Steering Committee for Honest John Launching and Handling Equipment, which was to meet once a month at the Rock Island Arsenal.[32] The launcher panel, as it was commonly known, consisted of representatives from the Office, Chief of Ordnance, the Douglas Aircraft Company, the White Sands Proving Ground, the Army Field Forces Board No. 1, and the Rock Island and Redstone Arsenals.[33]

(U) Though a valuable instrument from a viewpoint of program coordination and direction, the launcher panel was unable to block further delays in the delivery schedule. At the first panel meeting, on 27 March 1952, representatives of the Rock Island Arsenal gave what appeared to be a realistic date of 1 August 1952 for delivery of the self-propelled launcher, which was to be mounted on a modified M139 truck furnished by the Corps of Engineers.[34] However, the design engineering effort did not progress at the rate anticipated; and by 1 May, the delivery date had been changed from 1 August to the end of October 1952.[35]

(U) Unwilling to accept the excuses offered for the extended delay, the Assistant Chief of Ordnance, on 7 May, wrote the Arsenal commander an unduly critical letter, insisting that the "delay in delivery . . . until October 1952 is not understood," in view of the continually stressed urgency of the program and the fact that 6 months had elapsed since project initiation. "It is essential," he declared, "that the launcher be delivered to White Sands Proving Ground not later than 1 August 1952. If your arsenal cannot effect such a delivery, it is requested that this office be notified immediately in order that other

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[32] Ltr, ACofOrd to CO, RIA, 7 May 52, sub: HJ Lchr - Proj TU2-3008, DA Pri 1A. HJ R&D Case Files, Box 14-9, RHA AMSC.

[33] Tvl Rept, C. J. Koeper, 1 Apr 52, [HJ Lchr Panel Mtg, RIA, 27 Mar 52]. HJ R&D Case Files, Box 14-8, RHA AMSC.

[34] Ibid.

[35] Tvl Rept, C. J. Koeper, 8 May 52, [HJ Lchr Panel Mtg, RIA, 1 May 52]. HJ R&D Case Files, Box 14-8, RHA AMSC.

course of action be initiated."[36]

(U) This ultimatum, in effect, served notice that the arsenal would have to meet the 1 August delivery date or lose its mission to an agency that could. But for all it accomplished, it might just as well have been lost in the mail. The Rock Island Arsenal met neither the August nor the October delivery date. The first model of the self-propelled launcher arrived at the White Sands Proving Ground on 19 December 1952; some of the handling equipment followed in January.[37]

(U) By this time, the cost of the first set of prototype equipment had increased from the original estimate of $132,000 to $210,000, the difference of $78,000 being required for additional design and engineering effort. The commander of the Rock Island Arsenal had reported, in late September 1952, that the second set of equipment could be manufactured for about $10,000 less, or $200,000, and that the two additional sets could be built for about $170,000 each.[38] The arsenal subsequently built three more tactical prototype launchers, the last one being essentially identical to the final production model.[39]

(U) Self-Propelled Launcher, XM-289 (U)

(U) Development and Evaluation of Tactical Prototypes (U)

(U) The first tactical prototype of the self-propelled launcher consisted essentially of a launcher rail supported by an "A" frame and mounted on a 5-ton, 6-by-6, XM-139 truck chassis, together with

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[36](1) Ltr, ACofOrd to CO, RIA, 7 May 52, sub: HJ Lchr - Proj TU2-3008, DA Pri 1A. HJ R&D Case Files, Box 14-9, RHA AMSC. (2) Note that serious conflicts yet existed in tactical doctrine and equipment: General Simon was still trying to get a decision from the General Staff on 12 May, and the conflicts were not resolved until early June 1952. See above, pp. 145 - 46, 149 - 51.

[37]Monthly Prog Repts, Proj TU2-3008, Dec 52 & Jan 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

[38]2d Ind, CO, RIA, to CofOrd, 26 Sep 52, on Ltr, same to same, 9 Sep 52, sub: Lchr, Large Cal. ORDTU File, Sep 52 - Oct 52, MRB GSA FRC.

[39]Qtrly Prog Rept, Proj TU2-3008, Sep - Nov 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

associated traversing, elevating, and leveling mechanisms, fire control equipment, and electrical circuits. The launcher beam provided 30 feet of guidance for the rocket, this guidance length having been established as adequate during the first five feasibility demonstration firings.[40] This initial model, delivered to the White Sands Proving Ground in December 1952, was originally designated as the 580-mm. self-propelled rocket launcher, T135; but the nomenclature was later changed to 762-mm. self-propelled rocket launcher, XM-289.[41] For easy reference, it is hereafter identified as the XM-289-1.[42]

(U) Under normal circumstances, this initial prototype would have been subjected to a series of engineering tests to determine its operational suitability and to pinpoint the design deficiencies requiring correction. The mandatory design changes would have been incorporated and tested in succeeding R&D prototypes, and the production-engineered drawings for the final tactical model then released for industrial procurement purposes.

(U) Unfortunately, the urgent need for production launchers by the end of calendar year 1953 ruled out the normal development procedure and led to the adoption of a telescoped procedure designed to speed the delivery of tactical hardware by entering into production before completion of final drawings and product engineering. Under the crash program, some overlap in development and production phases would have been necessary in any event. But the 6-month delay in delivery of pilot equipment for engineering tests greatly increased the extent of overlapping effort

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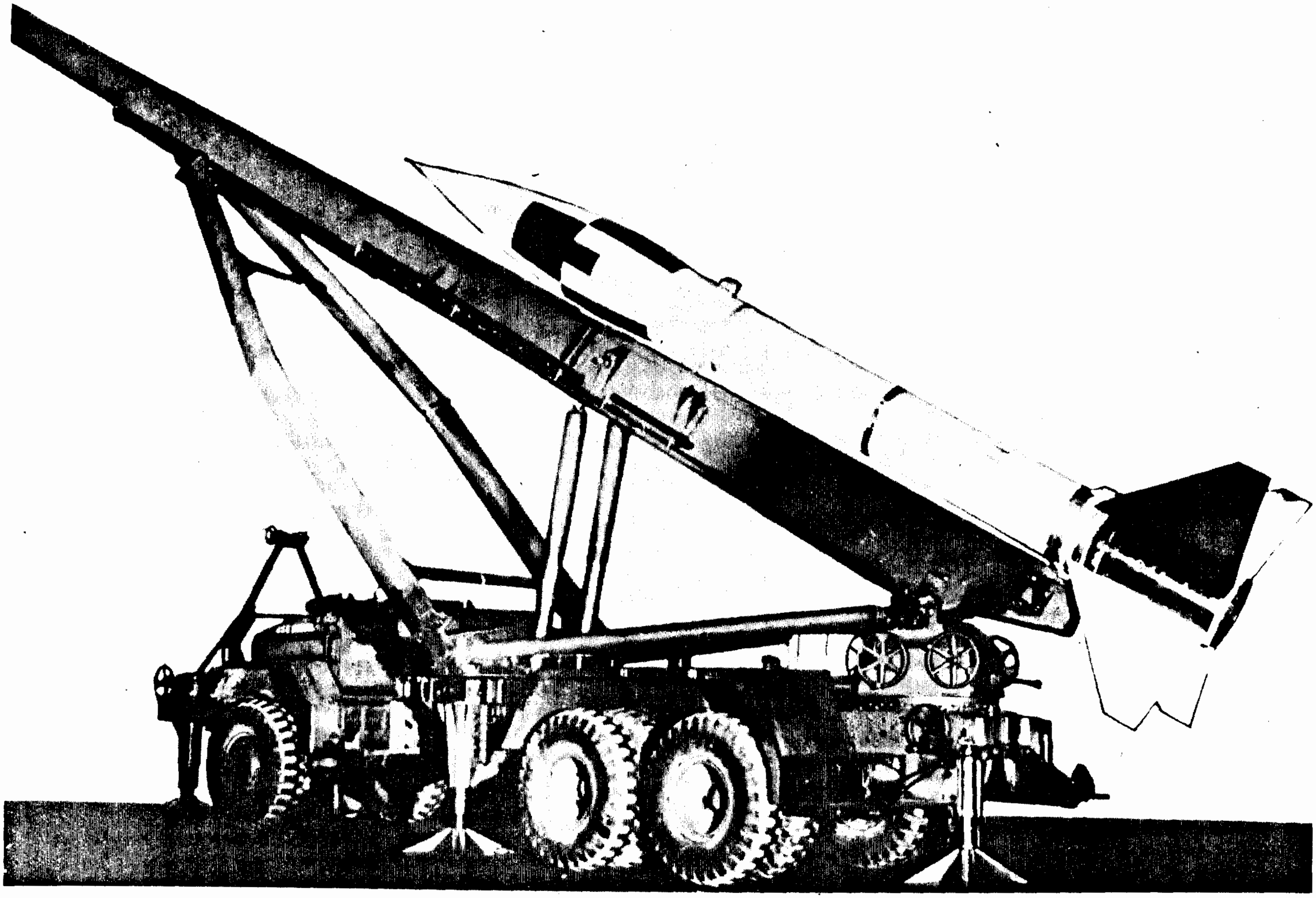
[40] HJ Blue Book, p. 37.

[41] (1) Monthly Prog Rept, Proj TU2-3008, Oct 52. HJ R&D Case Files, Box 14-9, RHA AMSC. (2) Ltr, CG, RSA, to DAC, 10 Apr 53, [Notes on Dev Type Mat]. HJ R&D Case Files, Box 14-8, RHA AMSC.

[42] The three companion models subsequently built by the Rock Island Arsenal are identified in a like manner: Namely, the XM-289-2, -3, and -4, respectively.

The "X" denotes experimental-type equipment and normally remains a part of the designation until the final tactical design has been proved, released for mass production, and classified as standard or substitute standard type.



Launcher, Rocket, 580-mm., T135; Left Rear, Firing Position, 30° Elevation (RIA, 15 Jan 53)

deficiencies, most of the necessary design changes being incorporated in the second pilot launcher (XM-289-2).[50]

(U) One of the most time-consuming changes involved the rebuild of the front end to withstand higher loads, the front axle of launcher XM-289-1 having failed in cross-country tests because of front-end overload. The design engineers equipped the second prototype with heavy-duty front springs and a tie-bar strut to stiffen the front axle housing, and increased the gear ratio of the traversing mechanism to lower handwheel loads.[51] Launcher XM-289-2, incorporating these and other design changes, arrived at the Aberdeen Proving Ground for road tests in May 1953—2 months behind schedule.[52]

(U) Upon completion of the road tests, the Aberdeen Proving Ground returned the second prototype to Rock Island for further modification. The Arsenal engineers reduced the load on the front axle from 18,400 pounds to 15,800 pounds by removing the winch and installing lightweight front jacks and a lightweight travel lock. Launcher XM-289-2 was then shipped to the White Sands Proving Ground for further proof tests, in August 1953. It demonstrated satisfactory performance in early tests; however, the test engineers recommended that the jacks on the next prototype be modified to increase the angle of departure.

(U) Launcher XM-289-3 arrived at the Aberdeen Proving Ground for limited engineering tests in September 1953—5 months behind schedule. This model was equipped with lightweight front jacks and a hinged rear

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[50] 2d Ind, CO, RIA, to CofOrd, 10 Apr 53, on Ltr, OCAFF to CofOrd, 20 Mar 53, sub: Rept on 580-mm SP Rkt Lchr, T135. ORDTU Files, Mar - Apr 53, MRB GSA FRC.

[51] (1) Monthly Prog Rept, Proj TU2-3008, Mar 53. HJ R&D Case Files, Box 14-8, RHA AMSC. (2) Johnson and Weston, "Development and Production of Rocket Launchers at Rock Island Arsenal, 1945 - 1959," II, 176.

[52] (1) Monthly Prog Rept, Proj TU2-3008, May 53. HJ R&D Case Files, Box 14-8, RHA AMSC. (2) The minutes of the Honest John conference, held at the Pentagon in December 1952 (footnote 43 above), stated that the second, third, and fourth prototypes were to be delivered in March, April, and June 1953, respectively.

jack; and the load on the front axle was further reduced from 15,800 pounds to 15,575 pounds. It subsequently took its place alongside the second pilot launcher at the proving ground for further proof tests in ballistic firings. Launcher XM-289-1 was then returned to Rock Island, where it was later converted to a lightweight model of the self-propelled launcher and redesignated as the XM-289E1.[53]

(U) By the end of November 1953, the Rock Island Arsenal had completed the design changes necessary to correct all known deficiencies and was in the process of fabricating the fourth and final pilot launcher according to the up-dated drawings being used in the manufacture of the 24 production launchers.[54] The Arsenal finished launcher XM-289-4, in January 1954, and kept it for use in a field service training program. This model was also used to proof test the latest design changes incorporated in production launchers.[55]

(U) Industrial Engineering and Production Problems

(U) Meanwhile, it had become apparent, in the late fall of 1953, that drastic measures would be necessary to meet the scheduled delivery of 50 percent of the production launchers and ancillary equipment by the end of 1953 as agreed to by the General Staff. In a last-minute effort to expedite the delivery of equipment required for deployment of activated batteries, the Commanding Officer of the Rock Island Arsenal had issued instructions prohibiting the introduction of nonessential design changes and urged the contractors and subcontractors to maintain their schedules as closely as possible. As an added measure, in December 1953, he had appointed Mr. Ernest A. Felsted as his special assistant to maintain closer control of the program and to assure prompt action on all

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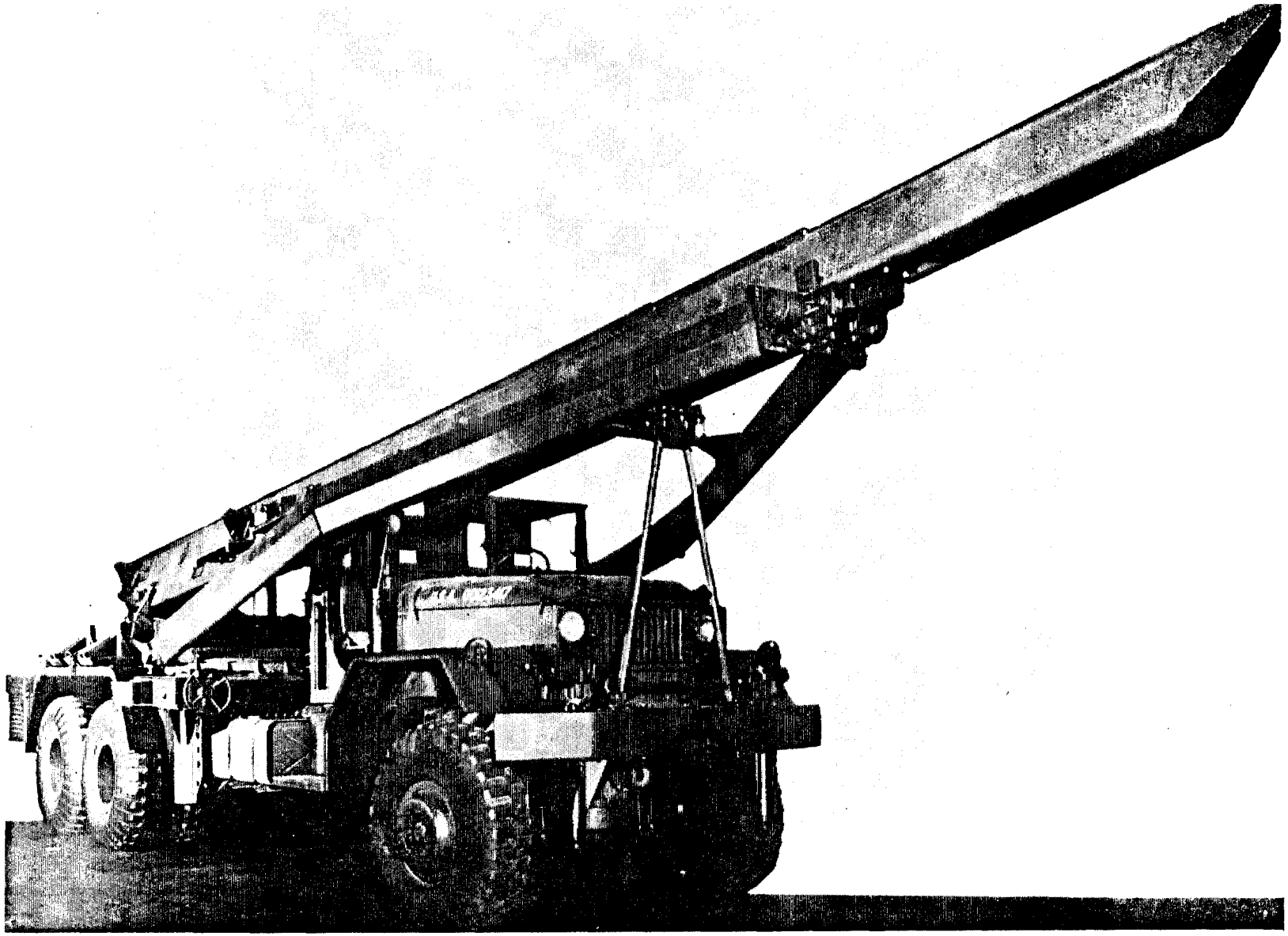
[53](1) Johnson and Weston, "Development and Production of Rocket Launchers at Rock Island Arsenal, 1945 - 1959," II, 177, 179 - 80. (2) For the parallel launcher development program, see below, pp. 201 - 14.

[54]Qtrly Prog Rept, Proj TU2-3008, Sep - Nov 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

[55]Johnson and Weston, op. cit., II, 178.



Launcher, 762-mm. Rocket, XM-289, Traveling Position, Serial No. 4 (RIA, 21 Dec 53)

matters which would affect the Arsenal's schedule commitments.[56]

(U) In addition to its responsibility for exercising technical supervision of the overall project (TU2-3008), the Rock Island Arsenal had been charged with the actual manufacture of certain ancillary equipment[57] and some spare parts for the launcher, as well as the publication of technical manuals. The Arsenal's manufacturing plant produced and delivered these items on schedule. But in spite of all that could be done, production problems developed in other phases of the program and the delivery schedule had to be revised. The new schedule, established near the end of December 1953, called for delivery of 50 percent of the total production quantities by 28 February 1954 and the remaining units by the end of May.[58]

(U) Critical production bottlenecks arose in the manufacture of the electric blanket, the M55 truck, and the circuit tester; however, the revised delivery schedule was essentially met for all these items except the circuit tester and the electric blanket. Problems and delays encountered in launcher production stemmed mainly from the over-lapped (or telescoped) R&D-production effort. As noted earlier, the launcher had been rushed into production at the Treadwell Construction Company, in April 1953, to meet urgent requirements for equipping the newly activated Honest John batteries. At that time, the R&D drawings were yet undergoing revision to correct deficiencies revealed in tests of the first R&D prototype. The urgency of the project had left the industrial engineers no time to process these drawings as was necessary to insure efficient and economical manufacture. Consequently, the contractor faced the problem of having to incorporate many important design

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[56] Mr. Felsted continued to serve in this capacity until 4 March 1954, at which time he returned to his normal duties as R&D project engineer on the XM-289 launcher. Ibid., II, 255, 257.

[57] Namely: 50 Heating & Tie-Down Kits (including two spares); 44 Handling Beams (including 12 spares); and a number of Assembly and Storage Racks. Ibid., II, 254.

[58] Ibid., II, 255 - 56.

changes arising from additional testing and from the lack of adequate industrial drawings.[59]

(U) The flow of design changes continued throughout production of the first 24 launchers. The initial units had scarcely reached the field when the Rock Island Arsenal released the drawings for additional design refinements. Very early in 1954, for example, the industrial engineers installed a shock-mounted travel lock on the XM-289-4 prototype and took steps to add this feature to the three launchers already in the field and to those yet in production.[60] With the steady stream of engineering change orders and the resulting duplication of effort in such areas as engineering, tooling, and documentation, spiraling hardware costs were inevitable—and it soon became evident that such cost increases would be substantial.

(U) The provisions of the contract authorized the Treadwell Construction Company to charge the Government both for the technical review of drawing revisions during production and for the actual cost of applying the modifications to the launchers in production or in the field. Upon receipt of revised drawings, the contractor proceeded with the manufacture of new components for each launcher, but held them until the final production unit had been completed. The task of retrofitting the launchers already in the field was then accomplished in one operation, mainly through the issuance of Modification Work Orders. This technique helped save time and money. However, as a result of the numerous Engineering Change Orders that had to be issued on the launcher during production, the final price paid to the contractor for each launcher amounted to $114,252. Added to this cost was $14,000 for Government-furnished equipment, consisting of the M139C truck.[61]

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[59] Ibid., II, 206 - 207.

[60] Ibid., II, 178, 255.

[61] (1) Ibid., II, 255, 258. (2) According to the Honest John Blue Book (pages 130 and 155), the total funds spent for the 24 launchers under Contract DA-11-070-ORD-8841 amounted to $2,741,567.55; whereas the above stated final unit price of $114,252 indicates a total cost of $2,742,048.

(U) As originally scheduled, the first production launcher was to have been delivered in October 1953, followed by 11 others by the end of that year to meet the minimum deployment requirements for activated batteries. However, the difficulty experienced in obtaining acceptable castings for the leveling jacks, coupled with other production problems resulting from the aforementioned conditions, forced a delay in delivery of the first launcher until early December 1953. At the end of that month, the second and third launchers had been accepted, and the schedule had been revised to provide for delivery of the next 9 units by 28 February and the remaining 12 by 31 May 1954.

(U) In a visible response to the measures taken to speed up production, the Treadwell Construction Company completed four launchers in January, six in February, six in March, and the final five in April 1954—several weeks ahead of the revised schedule. The contractor shipped the final launcher directly to the Rock Island Arsenal, where it was disassembled for personnel training purposes.[62] This launcher underwent cold tests at the Detroit Arsenal, in mid-1954, and was then shipped to the 6th Field Artillery Battalion, Fort Bragg, North Carolina, on 2 September 1954. The Treadwell Construction Company shipped the remaining 23 launchers directly to the various Honest John Field Artillery Battalions (FAB), as follows:[63]

Using Units	No. of Lchrs	Using Units	No. of Lchrs
Fort Sill, Okla.	(12)	Fort Bragg, N. C.	(8)
1st FAB	3	3rd FAB	3
5th FAB	3	6th FAB	2
7th FAB	3	85th FAB	3
84th FAB	3	Fort Bliss, Tex.	(3)
		550th FAB	3

(U) As explained earlier, most of the retrofit work on launchers in the field was held in abeyance until all the production units had been

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[62] Johnson and Weston, op. cit., II, 255 - 58.

[63] HJ Blue Book, p. 130.

finished. In addition to the modified parts already manufactured and ready for installation, the Rock Island Arsenal, in the summer of 1954, released the drawings of more than a dozen other design refinements for retrofit to launchers in the field. Aside from making design changes to correct deficiencies, the Arsenal devoted considerable effort to the reduction of manufacturing costs by simplifying component design and specifying less expensive materials and production processes.[64]

(U) In December 1955, the Ordnance Corps classified the XM-289 launcher and ancillary equipment as standard items.[65] With the final design of the M-289 launcher thus established, the Rock Island Arsenal shifted its attention, in 1956, to the task of developing the advanced XM-386 launcher for the Improved Honest John Weapon System.[66] The total R&D funds spent on the standard launcher system under Ordnance Project TU2-3008 amounted to $1,105,500, all but $60,000 of which was expended in the 5-year period from 1952 through 1956. In addition, the Arsenal received $8,800 in R&D funds during FY 1956 for support of the Honest John Arctic Test Program under Project TU2-1029.[67]

(U) The Rock Island Arsenal completed product engineering work on the standard M-289 launcher system in 1956; but engineering in support of follow-on production continued through the last procurement order in 1957. The Engineering Division received $146,104 for this final phase in March 1956.[68]

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[64] Johnson and Weston, op. cit., II, 178, 207.

[65] OCM 36012, 1 Dec 55; OCM 36040, 15 Dec 55. RSIC.

[66] Johnson and Weston, op. cit., II, 181.

[67] Ibid., I, fol p. 18. (Chart 1, "Research and Development Funds Authorized for Rocket Launcher Projects ... FY 1952—FY 1959," shows the following allotments, by fiscal year, under Project TU2-3008: 1952 - $160,000; 1953 - $149,100; 1954 - $428,400; 1955 - $108,000; 1956 - $200,000; 1958 - $60,000.)

[68] Johnson and Weston, op. cit., II, 208.

(U) Follow-On Production

(U) XM-289 Launchers for the Marine Corps

(U) The first follow-on production order, issued to the Rock Island Arsenal in October 1954, consisted of six XM-289 launchers with supporting equipment and spare parts for the Marine Corps. Included in the order were 12 XM-329 trailers; 27 XM1 electric blankets; 9 XM17 circuit testers; 6 XM6 warhead slings; 9 XM46 heating & tie-down kits; 6 XM4 rocket handling beams; 11 tool sets; and two sets of equipment peculiar to an Ordnance Rocket Support Unit.

(U) The Arsenal contracted production of the trailer and associated equipment to the Winter-Weiss Company (the on-trailer generators supplied by D. W. Onan & Sons, Inc.); and let a contract to the Douglas Aircraft Company for production of the circuit testers. The approximate unit price for the trailer was $2,100; the generator, $540; and the circuit tester, $1,000.

(U) The Frankford Arsenal furnished the fire control equipment, while the Ordnance Tank-Automotive Command supplied the M139C trucks for mounting the launcher, and the M55 trucks for the heating and tie-down kits. These two trucks cost about $15,000 each.

(U) In view of the low manufacturing workload at the Watertown Arsenal, the Rock Island Arsenal gave that installation a production order for the launching beam, traversing beam, and elevating A-frame. The manufacturing plant at Rock Island constructed the traversing platform and top carriage; installed the electrical equipment; and performed the final assembly of the launcher. It also constructed the handling beams, slings, and the heating and tie-down kits, and assembled the latter items on the trucks.[69]

(U) Since the XM1 electric blanket had been found unsatisfactory for field use, the Rock Island Arsenal deferred procurement of this item, pending availability of the improved XM2 blanket then under

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[69] Johnson and Weston, op. cit., II, 258 - 59.

development. In April 1955, with development of the latter essentially completed, the Arsenal provided the New York Ordnance District $70,000 for the procurement of 34 XM2 blankets, and an additional $99,570 for a large number of blanket sections (each blanket had 12 sections). The General Electric Company produced this equipment under a supplemental agreement to its basic R&D contract.[70]

(U) The original schedule called for completion of all launchers by 31 July 1955; however, because of insufficient time to procure supporting equipment, the schedule was revised, in mid-1955, to provide for final deliveries in October of that year. The Marine Corps received the first launcher, without any ancillary equipment, in June 1955; the second launcher and all 12 of the trailers followed in August. By 31 October, all of the launcher and supporting items had been delivered, except for the electric blankets, none of which had been completed. The Rock Island Arsenal completed the five launchers and ancillary equipment, in the latter half of 1955, at a cost of $660,000. The unit cost of each launcher, complete with the M139C truck, was $117,275. The aggregate cost of the entire launcher order was about one million dollars.

(U) The General Electric Company was unable to complete the 27 XM2 blankets on time, partly because of the deferred procurement action, but mainly because of difficulties experienced in stitching the quilted material without damaging the electric wires. The Marine Corps received the first three production blankets in January 1956; the other 24 units followed in the next few weeks.[71]

(U) Final Production—Standard M-289 Launcher System

(U) The Rock Island Arsenal received the first part of the final production order for XM-289 launchers in late November 1955. A few weeks later, the self-propelled launcher and most of its supporting

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[70] (1) Ibid., II, 259 - 60. (2) For details on development of the electric blanket and other items of ancillary equipment, see below, pp. 173 - 200.

[71] Johnson and Weston, op. cit., II, 260 - 61.

equipment—apparently all except the XM6 warhead handling sling—were type-classified as standard and redesignated accordingly. Included in the initial order were 44 M-289 launchers, 84 M46 heating and tie-down kits, 43 M31 rocket handling slings, 56 XM6 warhead handling slings, an assortment of tool sets, and a number of generator assemblies and housings. The Rock Island Arsenal manufactured all of this equipment, except for four major launcher components (beam assembly, traversing platform and beam, and elevating A-frame), which the Watertown Arsenal produced at an estimated cost of $1,188,604. The Ordnance Tank-Automotive Command supplied 116 M-329A1 trailers, as well as the M139C and M55 trucks for the launchers and heating and tie-down kits.

(U) An amendment to the production order, issued in February 1956, raised the number of launchers by nine, with production assigned to the Watertown Arsenal. Another change, in April 1956, further increased the order to include six launching systems for the Marine Corps, these also being assigned to the Watertown Arsenal. A final amendment, issued in June 1956, added 10 more launchers, to be manufactured by the Rock Island Arsenal, plus an undisclosed quantity to be produced by the Watertown Arsenal. Hence, the number of launchers on order at the Rock Island Arsenal totaled 54; with the Watertown Arsenal having orders for 15 - plus. During the same period, the production order was also expanded to include certain additional supporting equipment: namely, 53 sets of first echelon spare parts, tools, and equipment, and 57 additional heating and tie-down kits, increasing the total order for this item from 84 to 141.

(U) The General Electric Company found itself out of the blanket production business, in mid-1956, when the Security Parachute Company submitted a lower competitive bid. The Ordnance Weapons Command awarded the latter company a contract for production of 239 M2 electric blankets, in June 1956.[72]

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[72] Ibid., II, 261 - 62.

(U) The original schedule called for delivery of the initial order of 44 launchers by the end of November 1957, but several unforeseen problems prevented the Rock Island Arsenal from meeting this commitment. To obviate possible delays in procurement of materials, a list of estimated requirements had been developed and advance quotations obtained from suppliers well before receipt of the expenditure order. Nevertheless, some delays ensued because, in many cases, specified materials had to be readvertised for the second and third time to attract bidders. To alleviate this problem, the Arsenal's Engineering Division finally authorized some material substitutions. Yet another delay resulted from a late decision (March 1956) to incorporate in the launcher a new rear leveling jack, which was more difficult to fabricate because of the requirement for heat-treated and chrome-plated components.

(U) Despite these and other minor delays, the Arsenal managed to complete 32 of the 44 launchers by July 1957, and delivered the remaining 12 early in 1958. It delivered the other 10 launchers in the spring and summer of 1958, thus completing its share of the final production order. The unit cost of the 54 launchers was $77,116 without equipment, and $86,669 including all spare parts, equipment, and tooling. Total cost for the 54 launchers, spare parts, equipment, and tooling was as follows:

Item	Quantity	Total Cost
M-289 Launcher	54	$ 4,164,275.93
1st Echelon Spare Parts, Tools & Equipment	79	237,000.00
Sling Assembly	70	5,372.00
Sling Assembly	72	1,995.08
Handling Beam	69	43,125.00
Heating and Tie-Down Kit	141	179,095.81
Tool Set for Rocket Battery	31	8,250.96
Tool Set for Rocket Mechanic	31	1,642.07
Tool Set (Special) for Rocket Assembly & Loading	31	17,016.83
1st Echelon Equipment for M2 Blanket	339	11,461.59
1st Echelon Equipment for Housing & Generator Assembly (F8412460)	116	4,916.08
1st Echelon Equipment for Housing & Generator Assembly (F8407329)	141	5,975.58
	TOTAL COST:	$ 4,680,126.93

The manufacturing and tooling costs were divided as follows: direct labor, $1,114,640.67; overhead, $1,837,287,98; materials, $1,713,632.82; miscellaneous, $14,565.46. The direct labor hours charged to this order totaled 442,346.[73] The foregoing order concluded production of the M-289 launcher, which by this date had given way to the improved M-386 system, the first production prototype of the latter having been completed in the fall of 1957.[74]

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[73](1) Johnson and Weston, "Development and Production of Rocket Launchers at Rock Island Arsenal, 1945 - 1959," II, 262 - 65. (2) Cost information on equipment produced by the Watertown Arsenal is not available.

[74]Johnson and Weston, op. cit., II, 264.

CHAPTER VII

(U) DEVELOPMENT OF GROUND SUPPORT EQUIPMENT (U)

(U) The design and development of paraphernalia necessary for hauling, handling, and servicing the major system components began in the 1951 - 52 period. Some items of pilot equipment arrived at the White Sands Proving Ground in time for the engineering-user tests that started in January 1953; other prototypes followed later in the year. The Chief of Ordnance authorized the Rock Island Arsenal to proceed with procurement actions on most of the equipment in late July 1953, following a cursory engineering-user evaluation.[1]

(U) By October 1953, tactical prototypes of all ancillary equipment had been assembled at the proving ground for operational suitability tests by the joint Ordnance-Army Field Forces team.[2] In less than 2 months, the Ordnance Corps completed industrial procurement actions on all ancillary equipment, the tactical suitability of individual items again being based on early test results to expedite delivery of production units. Yet, with two exceptions, the modifications recommended for initial production models—after they had undergone vigorous field tests in early 1954—were remarkably few in number and, for the most part, relatively minor in nature.[3]

(U) Key items of ancillary equipment were developed by Government agencies and contractors. These identified by developing agencies, were

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[1](1) Ltr, 00 471.9/1043, CofOrd to CG, WSPG, 26 May 53, sub: Ancillary Hdlg & Lchg Equip for HJ. (2) Memo, Pvt Roger C. Guarino, Inf & Arty Rkt Sec, Proj Br, RDD, OML, RSA, to Dir, OML, 24 Jul 53, sub: Conf at RIA, 16 Jul 53, on HJ Ancillary Equip - Trip Rept. (3) Ltr, CofOrd to CO, RIA, 27 Jul 53, sub: HJ Lchr, Proc Prog C103-53. All in HJ R&D Case Files, Box 14-8, RHA AMSC.

[2]Qtrly Prog Rept, Proj TU2-3008, Sep - Nov 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

[3]Mary T. Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," (2 vols. and supplement, RSA, 1 July 1954), II, 228 - 29.

as follows:

Trailer, 762-mm. Rocket, XM-329 - Rock Island Arsenal
Sling, Head Handling, XM6 - Douglas Aircraft Company
Beam, Handling, XM4 - Rock Island Arsenal
Sling, Handling, M31 - Douglas Aircraft Company
Tester, Circuit, XM17 - Douglas Aircraft Company
Thermometer, Self-Indicating, XM2 - Redstone & Rock Island Arsenals
Heating & Tie-Down Kit, XM46 - Rock Island Arsenal
Rack, Assembly & Storage, XM8E1 - Rock Island Arsenal
Crate, Tactical Shipping - Douglas Aircraft Company
Blanket, Electric, XM1 - Rock Island Arsenal; General Electric Co.
Wind Measuring Set, AN/MMQ-1 - Signal Corps Engineering Laboratories

(U) Rocket Transport Trailer, XM-329

(U) As stated earlier, the Army Field Forces originally specified a requirement for an auxiliary rocket transport trailer capable of carrying two rockets, but later agreed to accept one carrying a single rocket, together with the necessary transfer equipment. The amended specifications further stated that the transport trailer could be towed by the self-propelled launcher, or it could have its own prime mover.[4] This portion of the design and development studies conducted by the Rock Island Arsenal eventually resulted in the XM-329 pole-type trailer. The Winter-Weiss Company fabricated the pilot trailer and provided 50 copies of "Notes on Development Type Materiel," at a total contract cost of $4,892.27.[5]

(U) Although the Army Field Forces had indicated their preference for the pole-type trailer over the M118 semitrailer, there appeared to be considerable misgivings among Ordnance specialists as to its usefulness. The latter opinion came to the fore during a conference in the Office, Chief of Ordnance, on 8 April 1953, shortly after the Rock Island Arsenal had completed preliminary tests of the pilot model. With specific reference to the results of these trailer tests, Lt. Col. W. C. Ohl, then the Honest John Project Officer, OCO, explained:

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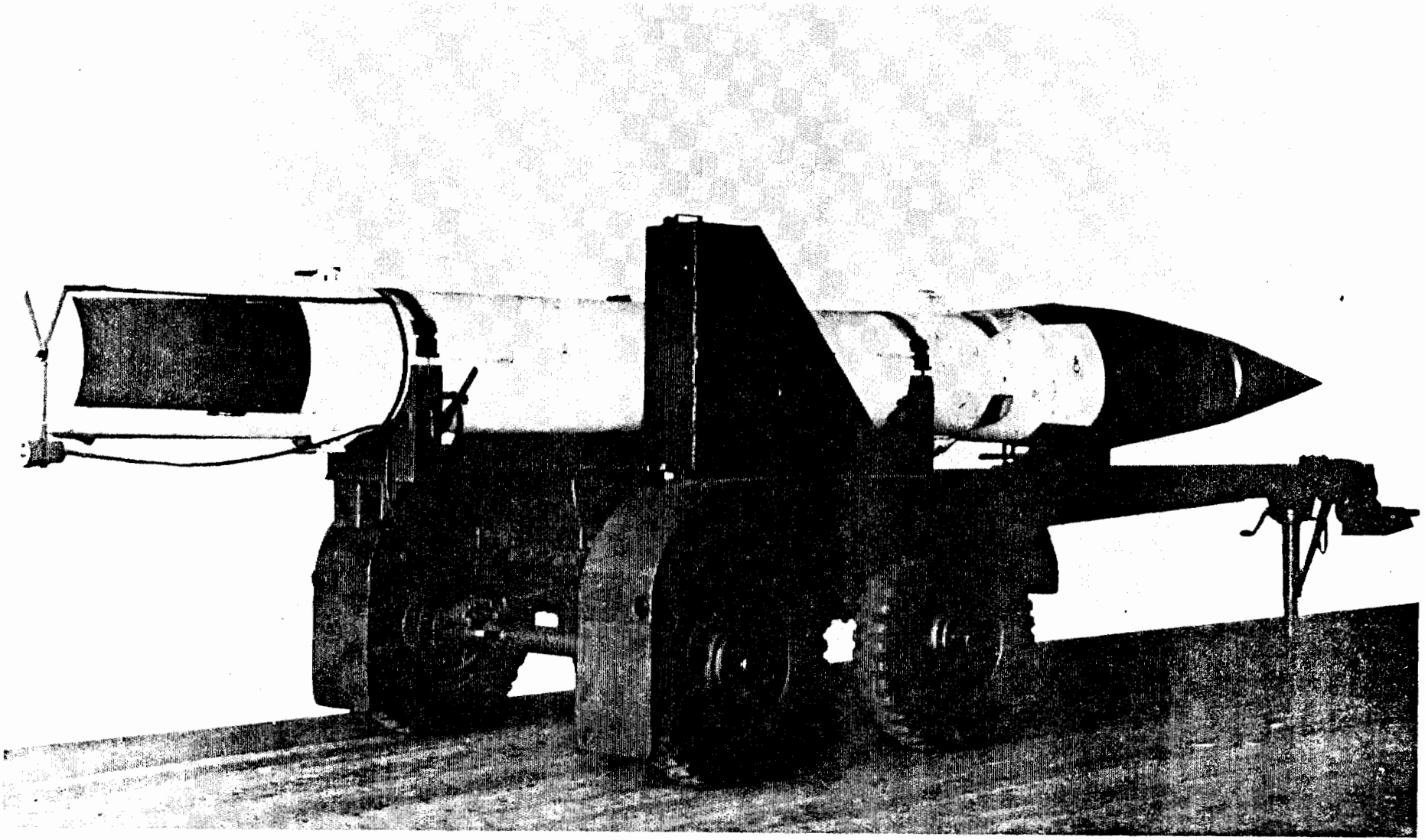
[4] See above, pp. 145 - 51.

[5] Ltr, CO, RIA, to CG, RSA, 11 Mar 53, sub: HJ Handling Equip. HJ R&D Case Files, Box 14-8, RHA AMSC.



Trailer, 762-mm. Rocket, XM329, Serial No. 2, Modifications (RIA, 20 Sep 54)

. . . When the boys put the rocket on it . . . and wheeled it around, they found that they had excessive deflection which is what we have been afraid of all along on this long pole-type trailer. Trying to convince Field Forces is virtually an impossibility until one is in a position to actually show them. What happened was that the deflection, both in the vertical and the horizontal plane, was such that we tended to twist the warhead off, which is a situation we can't condone. Rock Island is having it strengthened before shipping it to White Sands Proving Ground to see how it works.[6]

(U) Toward the middle of 1953, the test engineers at the proving ground conducted limited engineering-user tests on both the XM-329 pole-type trailer and the M118 cargo trailer, along with other items of ancillary equipment. As a result of this comparative evaluation, the test officer of the Army Field Forces indicated that the XM-329 trailer was the most desirable and, with certain modifications, would satisfactorily meet the established operational requirements. He also selected the M55, 5-ton, cargo truck for the dual function of serving as the prime mover for the pole trailer and transporting the rocket components.[7]

(U) By October 1953, the Rock Island Arsenal had completed the recommended design modifications to the prototype trailer and shipped the unit back to the proving ground for operational suitability tests.[8] On the basis of early test results, the Ordnance Corps, on 30 October 1953, signed a contract with the Winter-Weiss Company for production of 64 XM-329 trailers at a unit cost of $4,169.[9] The production schedule,

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[6]Min of Conf on HJ Rkt, OCO, 8 Apr 53. ORDTU File, Mar - Apr 53, MRB GSA FRC.

[7](1) Ltr, Hq, AFF Bd 1, Fort Bragg, N. C., to OCAFF, (undated) sub: Informatory Test of Assoc Equip for HJ (Third Partial Rept of Proj No. FA 2552), atch as Incl 1 to Ltr, CG, WSPG, to CofOrd, 10 Jun 53, sub: Testing of Ancillary Equip for HJ. ORDTU File, May - Jun 53, MRB GSA FRC. (2) DF, CofOrd to ACofS, G-4, 22 Jun 53, sub: Ancillary Equip for HJ Proj. HJ R&D Case Files, Box 14-8, RHA AMSC.

[8]Qtrly Prog Rept, Proj TU2-3008, Sep - Nov 53; Monthly Prog Rept, Dec 53. Both in HJ R&D Case Files, Box 14-8, RHA AMSC.

[9]The total value of this fixed-price contract (DA-11-070-ORD-9414) was $266,802. HJ Blue Book, p. 155.

established in December 1953, called for delivery of the first 32 trailers by February 1954 and the remaining 32 units by April 1954.[10]

(U) Meanwhile, the engineering-user operational suitability tests of the XM-329 trailer had pinpointed at least seven minor deficiencies which would have to be corrected in the final design.[11] The Rock Island Arsenal handled these design changes in much the same manner as those relating to the self-propelled launcher; the design fixes, as a general rule, being proved in field tests and then released to the production contractor in engineering change orders. Despite the problems resulting from the overlapped development-production effort, the Winter-Weiss Company completed the production order ahead of schedule. It delivered the first production model to Rock Island for qualification tests on 29 January 1954, and shipped the remaining 63 trailers directly to the using units in February and March 1954.[12]

(U) In November 1955, the Ordnance Tank-Automotive Command officially assumed all industrial responsibilities for the XM-329 trailer.[13] A few weeks later, the Ordnance Corps type-classified the XM-329 trailer as a standard item.[14]

(U) Servicing and Handling Equipment

(U) Handling Gear

(U) In addition to the above-mentioned handling devices,[15] the Rock Island Arsenal built a prototype of an alternate warhead handling bracket, and the Douglas Aircraft Company furnished an alternate rocket handling

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[10] Monthly Prog Rept, Proj TU2-3008, Dec 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

[11] WSPG Tech Rept No. 18, Jan 54, sub: Engineer-User Test of Honest John Ancillary Equipment, pp. 60-61. RSIC.

[12] HJ Blue Book, p. 139.

[13] Johnson and Weston, "Development and Production of Rocket Launchers at Rock Island Arsenal, 1945 - 1959," II, 208.

[14] OCM 36012, 1 Dec 55; OCM 36040, 15 Dec 55. RSIC.

[15] See above, p. 174.

beam. These models were dropped, however, after comparative evaluation tests in mid-1953.[16]

(U) After combined tests of the Honest John rocket and ancillary equipment in January 1954, the Army Field Forces indicated a preference for the XM4 handling beam over the M31 sling, because of difficulties encountered with the latter in handling the rocket with the electric blanket in place. The tests showed, however, that the rocket, without the blanket, could be more easily handled with the M31 sling than with the XM4 beam.[17] Since the electric blanket would be needed on the rocket only a small percent of the time, the Chief, Army Field Forces, later recommended that the M31 sling be procured as a line item on the same basis as the XM4 beam and in addition thereto.[18] The Rock Island Arsenal manufactured the initial order of 44 XM4 handling beams (including 12 spares) and let production contracts for 32 XM6 head handling slings and 35 M31 handling slings.[19]

(U) Circuit Tester

(U) In the summer of 1953, the Redstone Arsenal released the approved Ordnance drawings of the circuit (squib) tester, as designed by the Douglas Aircraft Company, for procurement by the Rock Island Arsenal.[20] Late in December 1953, the Arsenal negotiated a contract with the Douglas Aircraft Company for production of 50 testers, including 10 spares. The contractor was unable to deliver one-half of the production units by the

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[16] Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," II, 227 - 28.

[17] WSPG Tech Rept No. 18, Jan 54, sub: Engineer-User Test of HJ Ancillary Equip. RSIC.

[18] (1) Ltr, CG, RSA, to CofOrd, 2 Mar 54, sub: HJ Rkt Hoisting Cable Sling. (2) Ltr, OCAFF to ACofS, G-3, 24 Mar 54, sub: Sling Hdlg for HJ. Both in ORDTU File, Mar 54 - May 54, MRB GSA FRC.

[19] (1) Johnson and Weston, op. cit., II, 254. (2) HJ Blue Book, p.135.

[20] (1) Ltr, CofOrd to CO, RIA, 27 Jul 53, sub: HJ Lchr, Proc Prog C103-53. HJ R&D Case Files, Box 14-8, RHA AMSC. (2) Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," II, 228.

revised target date of 28 February 1954, partly because of the delay in completion of Ordnance drawings, but mainly because of the need for special, highly accurate components which were not commercially available. By promptly contacting the individual suppliers, through the Douglas Aircraft Company, the Rock Island Arsenal managed to reduce the lead time for these items from 90 to 30 days, and all of the production units had been delivered by early June 1954.[21]

(U) JATO Thermometer

(U) Initial work on the development of a JATO thermometer to measure the propellant temperature began at the Redstone Arsenal in August 1953. Two months later, the Rock Island Arsenal assumed responsibility for further development and procurement of this item, but Redstone continued work on the phases in which it was already engaged. The Redstone Arsenal released the final Ordnance drawings for procurement action in late October 1953, following tests with the electric blanket at the Aberdeen Proving Ground. The Rock Island Arsenal later purchased 225 of the XM2 thermometers for issue to field units and depot stock.[22]

(U) Tie-Down Kits; Trucks; Racks; Containers

(U) The Douglas Aircraft Company completed the final design of the tactical shipping crates in the late summer of 1953, and made arrangements to mount these crates on the M55 cargo truck (an M54 with extended wheel base). The Rock Island Arsenal, under great stress of time due to last-minute dimension changes, developed the XM46 Heating and Tie-Down Kit for securing the crates to the truck and supplying power to the electric blanket on the rocket motor.[23] The Arsenal's manufacturing plant produced the initial order of 50 XM46 kits, and also supplied the first 10 XM8 assembly and storage racks. The Arsenal contracted with

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[21](1) Ibid., II, 228. (2) Johnson and Weston, op. cit., II, 254, 256.

[22](1) HJ Blue Book, p. 138. (2) Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," II, 228.

[23]Ibid., II, 228.

D. W. Onan & Sons, Inc., to furnish the generator assemblies and their housings for mounting on the XM46 kits, and let a contract with the International Harvester Company for production of the M55 trucks.[24]

(U) The delivery of M55 trucks fell behind schedule because of a change in body styling. The Rock Island Arsenal was originally assigned responsibility only for manufacturing the XM46 kits and not for mounting them on the trucks. It later decided, however, that a better installation could be achieved if the equipment were mounted at the Arsenal before shipment. As of 23 February 1954, only three of the M55 trucks had been received; but by 8 March, 24 completely mounted trucks had been shipped to their destination by "commercial drive-away service."[25]

(U) Temperature Conditioning Equipment (U)

(U) XM1 Electric Blanket (U)

(U) The requirement for an effective temperature conditioning cover for the Honest John rocket represented one of the most difficult—if not the most expensive—problems of the entire project. The narrow temperature range over which the 4-DS-105,000, 202C1 rocket motor could be fired successfully dictated that some means be provided for controlling the temperature of the propellant grain under field conditions. Without such temperature control, the Honest John rocket would be limited in use by local atmospheric conditions, and therefore would be of little tactical value in its intended role as an all-weather weapon.[26]

(U) The Redstone Arsenal engineers recognized the existence of this problem in their launcher proposal submitted in September 1951. After extensive feasibility studies and theoretical analyses on both the rocket and launcher, they concluded that some type of temperature-conditioning cover would be required to extend the motor temperature limits, which were then set at +40°F. to +100°F. At that time, it appeared

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[24] Johnson and Weston, op. cit., II, 254.

[25] Ibid., II, 257.

[26] HJ Blue Book, p. 16.

feasible to design an insulated or air-conditioned box, or perhaps a blanket-type cover to inclose the rocket after it was mounted on the launching ramp. The motor could be exposed to temperatures as low as 0°F. or as high as+140°F. for a period up to 2 hours, thus allowing ample time between removal of the temperature cover and firing of the rocket. However, for temperatures below 0°F., the time period would be somewhat shorter.[27]

(U) Early in December 1951, the Chief of Ordnance instructed the Redstone Arsenal to design and have manufactured a temperature-conditioning cover capable of holding the propellant grain within the required firing temperature range of +40°F. to +100°F.[28] Using the calculations and drawings developed for similar devices in other programs—such as the blanket for the Nike Ajax booster—and propellant data obtained from the Allegany Ballistics Laboratory, the design engineers prepared a tentative set of specifications for a blanket design that would be compatible with the XM-289 launcher then under development at Rock Island.[29]

(U) By late March 1952, the project had reached the point where very close coordination was essential between the mechanical design of the blanket and the launcher and rocket mounting design. Since the Rock Island Arsenal had technical responsibility for the development of launching and handling equipment, members of the launcher panel agreed, at a meeting on 27 March, that it should also assume responsibility for the design, development, and procurement of the temperature-conditioning cover.[30] Two weeks later, the Commanding Officer of the Redstone Arsenal

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[27]RSA Rept T-3-a, 14 Sep 51, sub: Tactical Type Lchrs for the HJ Rkt, p. 2. RSIC.

[28]Ltr, 00 471.94/816, CofOrd to CO, RSA, 5 Dec 51, sub: Lchg & Hdlg Equip - HJ Proj TU2-3008, Pri 1A. HJ R&D Case Files, Box 14-9, RHA AMSC.

[29]Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," II, 222 - 23.

[30]Tvl Rept, C. J. Koeper (RSA), 1 Apr 52, [HJ Lchr Panel Mtg, RIA, 27 Mar 52]. HJ R&D Case Files, Box 14-8, RHA AMSC.

transferred the technical responsibility for the blanket project to the Rock Island Arsenal, along with pertinent files outlining temperature requirements, operations characteristics, and other necessary data.[31]

(U) Early in September 1952, the Rock Island Arsenal negotiated a fixed-price contract for $7,565 with the General Electric Company for the design and manufacture of one complete heating blanket and preliminary engineering studies on its adaption as a cooling blanket. Phase I of the contract embraced the fabrication of one five-segment heating unit for experimental purposes in developing the first complete prototype blanket under Phase II.[32] In mid-December 1952, the Rock Island Arsenal issued a supplemental agreement, authorizing the contractor (1) partially to destroy and retain the Phase I experimental unit and (2) to manufacture one additional prototype blanket under Phase II. This change increased the total amount of the contract to $18,390.[33]

(U) The Rock Island Arsenal received the first two electric blankets in January 1953, and awarded the General Electric Company "another contract" for the development of a cooling and heating blanket.[34] Following extensive engineering-user tests of the XM1 prototype blankets, in the first quarter of 1953, the Rock Island Arsenal issued a change order to the basic contract, providing for the incorporation of some 15 design modifications in the second pilot model to correct noted deficiencies and to make it compatible with the Type II Honest John rocket. This order, signed in April, increased the value of the contract by $2,810, making a total R&D cost of $21,200.[35]

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[31] Ltr, CO, RSA, to CO, RIA, 10 Apr 52, sub: Lchg & Hdlg Equip - HJ Proj TU2-3008, Pri 1A, w/7 Incls. HJ R&D Case Files, Box 14-90, RHA AMSC.

[32] Contr DA-11-070-ORD-8315 (PO 53-1515), 3 Sep 52.

[33] Mod 1, Suppl Agmt 1 to Contr ORD-8315, 15 Dec 52.

[34] Johnson and Weston, op. cit., II, 176. (Contract data on the latter program not available.)

[35] Mod 3, Change Order 3, to Contr ORD-8315, 2 Apr 53.

(U) By late July 1953, the modified tactical prototype had been completed and shipped to the Aberdeen Proving Ground for further tests preparatory to the completion of final production drawings and specifications. To meet the scheduled delivery of one-half of the first 150 production units by 31 December 1953, these tests would have to be completed and the final drawings released to production no later than October. But the proving ground encountered two major problems which delayed the test for nearly 2 months. First, it found that some parts of the blanket had not been received, and the complete unit was not assembled and ready for test until 31 August. It then experienced another delay because necessary power-recording instruments were not available. The test finally got under way on 21 September and continued through 17 October 1953. After a review of the test results, during a conference at the proving ground on 30 October, Lt. Col. W. C. Ohl of the Office, Chief of Ordnance, decided that additional tests should be conducted before final release of production drawings. The Aberdeen Proving Ground completed these tests on 13 November, and furnished the Rock Island Arsenal a complete report, including the recommended design changes for correction of noted deficiencies.[36]

(U) Meanwhile, pending completion of the tests at the Aberdeen Proving Ground and to obviate as many last-minute delays as possible, the Rock Island Arsenal had negotiated a supplemental agreement, authorizing the contractor to procure the cloth and certain other material for 150 XM1 electric blankets to be produced under Phase III of the contract. This agreement, signed in October, allowed the General Electric Company a unit price of $1,835—a total of $275,250 for the 150 blankets—and increased the total contract amount to $296,450.[37] Exactly 1 month later, on 16 November, the Arsenal released the production drawings of the XM1 blanket, together with another contract modification

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[36] 1st Ind, APG 471.94/24, to CO, RIA, undated, attached as Incl 3 to 1st Ind, APG to RIA, 17 Jun 54, on Ltr, RIA to APG, 28 May 54, sub: Temp Condg Blanket for HJ Rkt. ORDTU File, Jun 54 - Aug 54, MRB GSA FRC.

[37] Mod 5, Suppl Agmt 4, to Contr ORD-8315, 16 Oct 53.

delineating 13 changes in design and/or material specifications. As a result of these changes, the unit price of the production blankets jumped to $1,859.50, thereby adding $3,675 to the total production cost and increasing the over-all contract value to $300,125.[38]

(U) Because of the delay in commencement of production, it became necessary, in late November 1953, to accelerate the production and delivery schedule. For a sum of $4,680—which increased the contract value to $304,805—the General Electric Company agreed to expedite production to the extent necessary for delivery of the first 31 blankets by 17 January 1954 and the remaining 119 units at the rate of 10 per week to complete the order by 11 April 1954.[39]

(U) The General Electric Company not only failed to meet the accelerated delivery schedule, but was equally unsuccessful in its attempt to meet some of the material requirements and specifications. As noted above, the procurement and manufacture of cloth had started a month before the production release of the blanket; however, since the cloth was new and untried, it had to undergo prolonged fungus tests and be properly certified before use. To compound the problem, the General Electric Company failed to have enough cloth manufactured in the first lot, with the result that the test and certification process had to be repeated on at least two other occasions.[40] Also contributing to the delay was a late change order, issued in January 1954, which called for an olive drab finish on the aluminum braces. This change added $500 to the production cost and increased the total contract value to $305,305.[41]

(U) Upon delivery of the first 31 XM1 Electric Blankets, in the

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[38] Mod 6, Change Order 5, to Contr ORD-8315, 16 Nov 53.

[39] Mod 7, Suppl Agmt 6, to Contr ORD-8315, 23 Nov 53.

[40] Johnson and Weston, op. cit., II, 256.

[41] Mod 9, Change Order 7, to Contr ORD-8315, 22 Jan 54.

first half of February 1954,[42] the contractor discovered that the stitching and seaming were not fungus-proof and therefore did not meet the specifications outlined in the basic contract. This revelation prompted the suspension of further production for some 3 weeks while the contractor made a futile attempt to remedy the trouble.[43]

(U) To expedite production, the Government finally agreed, early in March 1954, to relax the requirement for a fungus-proof outer covering and to accept 27 of the blankets at a price reduction of $25 each, thereby reducing the total contract price by $675.[44] More problems developed a few weeks later, when 800 yards of the quilted material being used in production started showing signs of mildew or fungus growth. Because of the urgent need for the equipment, the Government again relaxed the specifications and agreed to accept 20 more of the blankets at a price reduction of $5 each, further reducing the contract value by $100.[45] With these two changes, the amount payable under the contract dropped from $305,305 to $304,530, as shown below.

Phases I & II: R&D - 2 Prototypes.....		$ 21,200.00
Phase III: Production 150 Blankets -		
27 @ $1,834.50.....	$ 49,531.50	
20 @ $1,854.50.....	37,090.00	
103 @ $1,859.50.....	191,528.50	
Other Expenses (Mods 7 & 9).....	5,180.00	$283,330.00
Total Contract Value, 31 Mar 54.....		$304,530.00

(U) The contractor resumed deliveries in March, and by the end of April, 107 XM1 electric blankets had been shipped, 95 of them directly to the artillery battalions and 12 to the Rock Island Ordnance Depot.

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[42]The manufacturer shipped the first production blanket to the Rock Island Ordnance Depot, on 1 February. The next 12 units were shipped directly to using units at Fort Bliss, Tex., on 9 February; followed by 12 to Fort Sill, Okla. and 6 to Fort Bragg, N. C., on 11 February. HJ Blue Book, p. 132.

[43]Johnson and Weston, op. cit., II, 256.

[44]Mod 10, Change Order 8, to Contr ORD-8315, 3 Mar 54.

[45]Mod 11, Change Order 9, to Contr ORD-8315, 31 Mar 54.

Of the 12 remaining units, 11 were shipped to the field on 14 May, and the other to the Rock Island Ordnance Depot on 20 May 1954.[46]

(U) The Rock Island Arsenal delayed the procurement of spares until the aforementioned production problems were solved.[47] By supplemental agreement, signed early in May 1954, the Arsenal ordered 24 additional XM1 blankets, which were to be delivered at the rate of 6 per week beginning on 17 May and ending on 11 June 1954. The parties to the contract agreed to a unit price of $1,807 or a total cost of $43,368, thereby increasing the gross value of the contract to $347,898.[48]

(U) Meanwhile, the Rock Island Arsenal learned that the XM1 electric blanket (see photograph) had been declared unfit for tactical use and would have to be completely redesigned. The results of rigorous field tests at White Sands—which results were confirmed in tactical tests of the Honest John Weapon System during Exercise Flashburn in late April 1954—indicated the need for vast improvements in ruggedness, simplicity, and speed of application under tactical conditions. Most of the deficiencies stemmed from faulty material and construction; that is, the blanket was subject to easy tearing or ripping under field conditions, and the method of attaching the straps to the blanket proved inadequate for field service. In addition, the Army Field Forces took exception to the blanket design in general, particularly the complicated system of ties, closures, and buckles, which would prevent the installation and removal of the blanket with the desired speed under combat conditions

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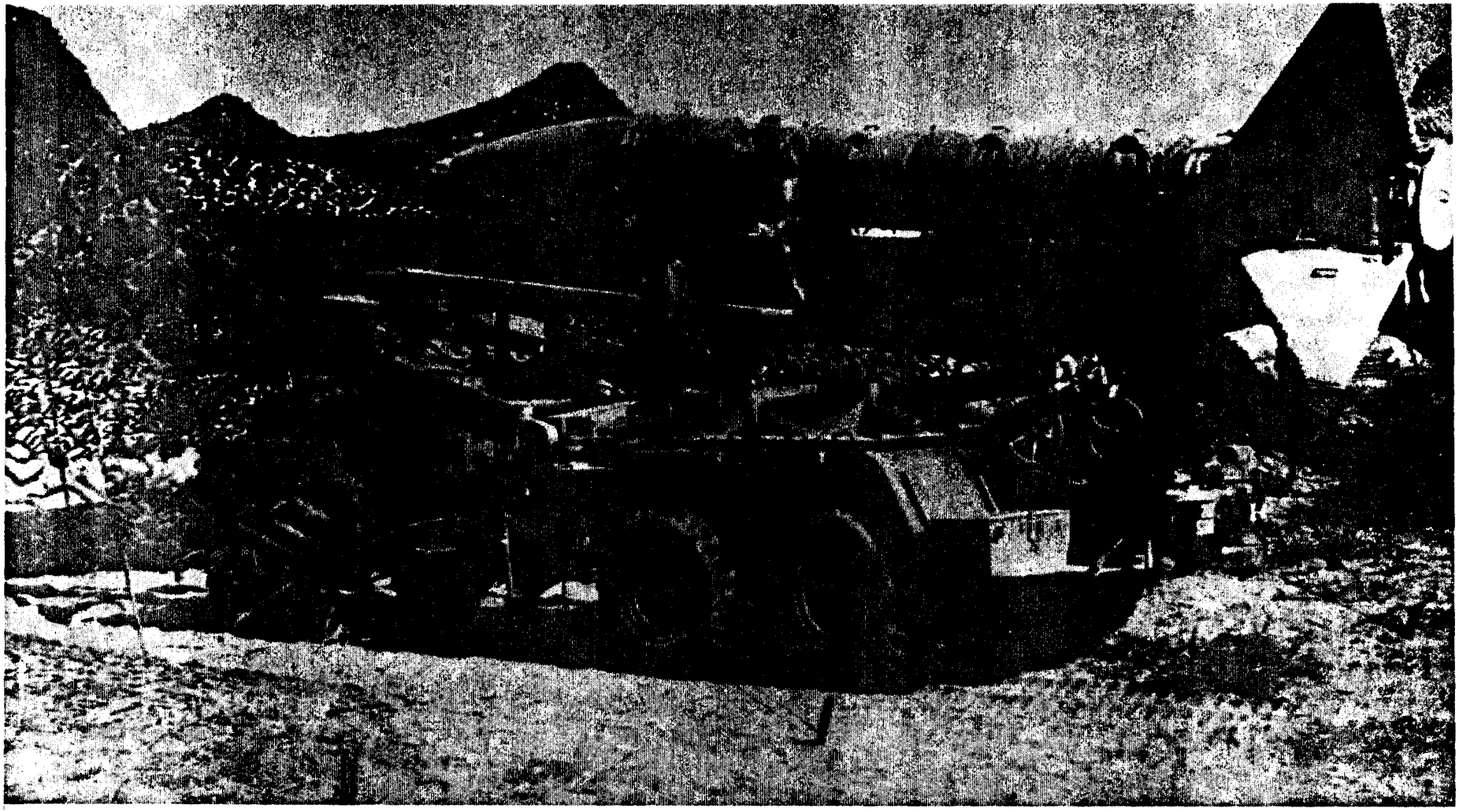
[46](1) HJ Blue Book, p. 132. (2) Annex 3-III of the Honest John Blue Book shows the following disposition of the 14 units consigned to the Rock Island Ordnance Depot: 5 each to the New York Port of Embarkation (23 Apr 54); and 8 each to locations within the United States (including 1 each to the Rock Island Arsenal and the White Sands Proving Ground); leaving a depot inventory of one as of 30 June 1955.

[47]Johnson and Weston, op. cit., II, p. 257.

[48]Mod 12, Suppl Agmt 10, to Contr ORD-8315, 4 May 54.



XM1 Electric Blanket Installed on Honest John Rocket

and especially during periods of extreme cold.[49]

(U) XM2 Electric Blanket

(U) Accordingly, the Chief of Ordnance, in the summer of 1954, authorized the Rocket Island Arsenal to proceed with the preparation of revised specifications for the development of a new heating blanket, to be designated as the XM2.[50] To provide existing troop units with serviceable equipment on an "interim basis," the Rock Island Arsenal immediately began collecting the XM1 blankets, a few at a time, for the purpose of reinforcing the ties and closures, thereby permitting the continued use of such blankets until rendered unserviceable in the normal manner. In reporting these actions to the General Staff, in September 1954, Maj. Gen. Leslie E. Simon, the Assistant Chief of Ordnance, noted that no additional blankets of the XM1 design would be procured. He also stated, "All blankets for future procurement will be constructed of a new material having many times the strength of the previous material used and which is very highly tear resistant."[51] (In this connection, it is interesting to note that the fabric selected for XM1 blanket was also "new" and had been in production use less than a year—since October 1953. If it can be assumed here that this material was the best available at that time, then the new and much stronger fabric available for the XM2 design, as quickly as September 1954, must have been the product of incredibly rapid advancements in textile engineering.)

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[49](1) Memo, Chf, ORDTU, to Maj Gen Leslie E. Simon, 7 May 54, sub: Rept of Activities - HJ. ORDTU File, Mar - May 54, MRB GSA FRC. (2) Ltr, CofOrd to CO, 51st FAG, Ft Bragg, N. C., 17 Jun 54, sub: Condg Blankets HJ Rkt. ORDTU File, Jun - Aug 54, MRB GSA FRC. (3) 2d Ind, ACofOrd to ACofS, G-4, 13 Sep 54, and Incl 1 thereto, on Ltr, OCAFF to ACofS, G-4, date unk, sub: Deficiencies on Blanket, Elec, 762-mm. Rkt, XM1. ORDTU File, Sep - Dec 54, MRB GSA FRC.

[50]1st Ind, CofOrd to CO, RIA, 9 Sep 54, on Ltr, CO, RIA, to CofOrd, 27 Aug 54, sub: Elec Blanket for HJ Rkt. ORDTU File, Sep - Dec 54, MRB GSA FRC.

[51]2d Ind, ACofOrd to G-4, 13 Sep 54, on Ltr, OCAFF to ACofS, G-4, sub: Deficiencies on Blanket, Elec, 762-mm. Rkt, XM1. ORDTU File, Sep - Dec 54, MRB GSA FRC.

(U) Early in October 1954, the Chief of Ordnance approved the new specifications for the XM2 blanket and authorized the Rock Island Arsenal to procure a pilot model for test and evaluation. Obviously mindful of the mistakes made in the previous program, he specifically requested that his office "be kept continually advised of the progress of the pilot model design in order that any features of such design which do not appear to meet tactical requirements may be brought to the attention of the contractor and corrected without delay."[52]

(U) The General Electric Company commenced work on the XM2 design in the fall of 1954, apparently under a letter order agreement.[53] The formal, fixed-fee contract was not signed until 28 December 1954.[54] By the end of April 1955, the R&D phase had been completed and field tests of the XM2 prototype (see photograph) were under way. A short time later, the New York Ordnance District entered into a supplemental agreement with the General Electric Company for production of 34 XM2 blankets and a large number of blanket sections.[55]

(U) The Cooling & Heating Blanket Fiasco

(U) In the meantime, the attempt to develop a cooling and heating blanket for the Honest John rocket[56] had emerged as a classical comedy of errors, with Government officials heading the cast and the contractor left holding the proverbial bag. The General Electric Company completed the R&D prototype of this blanket in the early months of 1953, and

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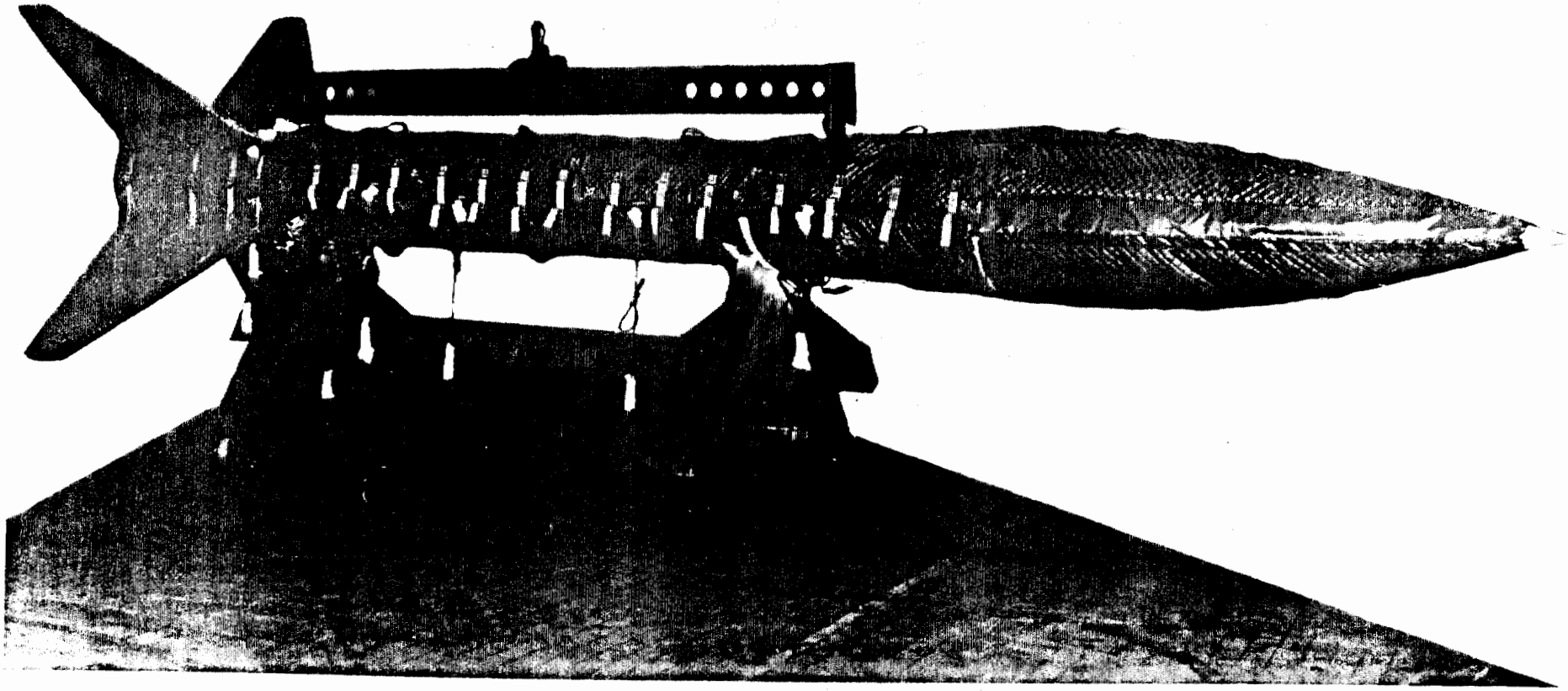
[52] Ltr, 00/4U0-40986, CofOrd to CO, RIA, 5 Oct 54, sub: Heating Blanket Specs - HJ Rkt. ORDTU File, Sep - Dec 54, MRB GSA FRC.

[53] Johnson and Weston, op. cit., II, 179, 259.

[54] (1) Ibid., II, 259 - 60. (2) HJ Blue Book, p. 151. Contract DA-30-069-ORD-1434 was later supplemented to provide for initial XM2 production. Its total dollar value amounted to $194,725, including about $25,155 for the R&D phase and the remaining $169,570 for production of 34 XM2 blankets and a large number of blanket sections.

[55] (1) Johnson and Weston, op. cit., II, 259 - 60. (2) For details on problems and delays encountered in production of the XM2 see above, pp. 167 - 68.

[56] See above, p. 182.



Blanket, Electric, 762-mm. Rocket, XM2, Lifting Beam in Position (RIA, 9 Mar 56)

released it for Government test and acceptance. Some 18 months later, the prototype had neither been tested nor accepted—and the General Electric Company was yet to be reimbursed for its effort.

(U) The chain of events which ultimately led to the rejection of the conditioning blanket began with its arrival at the Aberdeen Proving Ground in late July 1953. Problems and delays and frustrations abounded from the very beginning. Except for the assembly of necessary test equipment, nothing could be done until the higher priority tests of the XM1 blanket were finished in mid-November 1953. At that time, however, the test was again delayed for want of a 5-kilowatt variac (voltage regulator), which was to have been supplied by the General Electric Company. The Aberdeen Proving Ground finally located a suitable variac at the Picatinny Arsenal and arranged to borrow it for the period of the test.

(U) The test engineers received the variac on 14 December 1953, but their problems were far from solved. Upon installing the blanket on the rocket, they ran into other roadblocks which should have been detected and remedied in the 6-month waiting period. First, they found that the blanket did not fit properly and had to call in contractor personnel to assist in the necessary modifications. Then, after fitting the blanket on the rocket and connecting the fluid lines, they discovered that the blanket hoses were "full of leaks," and set about the task of repairing them—at the request of the contractor. The blanket was again ready for test on 8 January 1954.

(U) Meanwhile, the cold room operating personnel had begun other higher priority tests which continued until 25 January 1954. At this point, Colonel Ohl, of the Office, Chief of Ordnance, requested that the Honest John warhead compartment be shipped to the Picatinny Arsenal. Proving ground personnel argued that this would cause further delay in the blanket test; but Colonel Ohl insisted on the release of the warhead, with the promise that it would be returned by the middle of February 1954. The rocket warhead left Aberdeen on 29 January 1954; the shop-worn blanket—now nearly a year old—resumed its place in the

storage room.[57]

(U) Five months later, the warhead was still at Picatinny Arsenal; the blanket was still gathering dust at Aberdeen; and the Rock Island Arsenal was still collecting requests for payment which could not be honored, under provisions of the contract, until completion of tests and formal acceptance by the Government. Having failed to receive the warhead at the appointed time, the Aberdeen Proving Ground had proceeded with other high priority cold-room tests which would not be completed until late September 1954. In addition, at least a month would be required after receipt of the warhead to re-set the instruments and test material to the point where they were when dismantled in late January 1954. Assuming receipt of the warhead by September, the blanket test could not be completed until January 1955, and the final test report would not be available to close out the contract until March or April.[58]

(U) In view of this revelation, in late June 1954, and the growing stack of duns from the contractor, the Commanding Officer of Rock Island Arsenal had no alternative but to pass the buck to Colonel Ohl. "This office," he said, "is consistently getting correspondence from the contractor requesting payment for this blanket and we lack sufficient information to explain why test and acceptance has not been made to date."[59]

(U) This action brought fairly prompt results: the Picatinny Arsenal shipped the warhead compartment back to Aberdeen by commercial carrier on 28 July 1954.[60] Realizing that the Aberdeen Proving Ground

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[57] 1st Ind, CG, APG, to CO, RIA, undated; attached as Incl 3 to 1st Ind, APG to RIA, 17 Jun 54, on Ltr, RIA to APG, 28 May 54, sub: Temp Condg Blanket for HJ Rkt. ORDTU File, Jun - Aug 54, MRB GSA FRC.

[58] 1st Ind, CG, APG, to CO, RIA, 17 Jun 54, w/5 Incls, on Ltr, 28 May 54, foregoing footnote.

[59] 2d Ind, CO, RIA, to CofOrd, 30 Jun 54, on Ltr, RIA to APG, 28 May 54, sub: Temp Condg Blanket for HJ Rkt. ORDTU File, Jun - Aug 54, MRB GSA FRC.

[60] TT 5268, CO, PA, to CG, RSA, et al., 28 Jul 54. ORDTU File, Jun - Aug 54, MRB GSA FRC.

still would be unable to complete the blanket test until January 1955, the Commanding General of Redstone Arsenal suggested that the test be conducted at his installation where cold-room facilities were immediately available and where the test could be completed within 60 days after receipt of equipment. At the same time, concurrent tests could be conducted on a redesigned JATO thermometer, as well as surveillance, handling, and environmental evaluation of the blanket itself. Lt. Col. A. L. Stevens, of the R&D Division, OCO, promptly embraced this plan without reservation, and ordered the Aberdeen Proving Ground to ship the blanket and warhead to Redstone Arsenal.[61]

(U) The prototype cooling and heating blanket—now approaching its second birthday—arrived at Redstone Arsenal in the early fall of 1954. The results of tests conducted a short time later revealed that the blanket did not meet the desired performance standards and therefore should not be accepted by the Government. In the succinct opinion of John A. Robins, one of the test engineers: "It simply was no damn good."[62]

(U) The exact monetary cost of this program to the Government is not readily available; but it would undoubtedly be dwarfed by the price paid in embarrassment and loss of prestige, alone, to say nothing of the immediate and long-range effect on Army-Industry relationships. It is, in short, a classic example of how best not to manage a program, however unsatisfactory the end product.

(U) Wind Measuring Equipment (U)

(U) While the Rock Island Arsenal thus fought the development and production battles of the rocket launcher and associated handling gear, the Signal Corps Engineering Laboratories tackled the complex problem

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[61] Ltr, 00/4UO-34578, to CG, APG, 19 Aug 54, sub: Condg Blanket 762mm Rkt, M31 (HJ). ORDTU File, Jun - Aug 54, MRB GSA FRC.

[62] Intvw, Mary T. Cagle with John A. Robins, 19 Sep 63. Mr. Robins was closely associated with the Honest John project from its inception. He is currently assigned to the Office of the Deputy Commanding General for Ballistic Missiles, Army Missile Command.

of developing a suitable wind measuring set to complete the array of Honest John ground equipment. This final item of equipment was profoundly important to the tactical operation of the Honest John Weapon System, for the achievement of desired accuracy would largely depend upon the precise measurement of wind speeds and directions.

(U) Very early in the rocket development program, Ordnance engineers recognized that winds in the first 350 feet of air mass would have a profound effect on the accuracy of the large-caliber, free-flight rocket. Early theoretical estimates indicated that the latent deviation (deviation at motor burnout) would be about 2.5 milliradians per foot per second of wind blowing constantly throughout the burning period in a direction normal to the trajectory of the rocket. After the first five R&D firings, in mid-1951, the Chief of Ordnance directed that subsequent ballistic rounds be fired in pairs for further evaluation of the influence of winds on dispersion. The results of 10 firings, conducted later in 1951, confirmed that meteorological conditions represented one of the main causes of rocket dispersion. To achieve the desired accuracy of ±200 yards lateral dispersion, extremely accurate instruments would be required for the precise measurement of wind speeds and directions at various heights and locations.[63]

(U) Since there were no standard instruments which would fulfill the stringent accuracy requirements, the Chief of Ordnance, in November 1951, had the Redstone Arsenal compile a set of interim military characteristics for new equipment to be designed and developed by the Signal Corps Engineering Laboratories.[64] The specifications submitted to the

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[63] HJ Prog Rept, 1 Dec 51 - 29 Feb 52, RSA T&E Div. HJ R&D Case Files, Box 14-8, RHA AMSC.

[64] (1) 1st Ind, OO 400.112/1808, CofOrd to CO, RSA, 21 Nov 51 (date, sub of basic ltr unk). ORDTU File, Sep 51 - Nov 51, MRB GSA FRC. (2) The Chief, Army Field Forces, sent the General Staff a statement of formal Army requirements for meteorological equipment, in February 1953; the approved specifications reached the developing agency 2 months later. Ltr, ATDEV-5 471.94/21, CCAFF to ACofS, G-3, 13 Feb 53, sub: AFF Bd No. 1, Proj No. FA 1152, Rept of Study of Met Equip for HJ; atch as Incl 1 to Cmt 2, G4/F4-17381, ACofS, G-4, to CSigO, 16 Apr 53, same sub. ORDTU File, Mar - Apr 53, MRB GSA FRC.

Chief Signal Officer in late December 1951 called for a compact, mobile weather station with the necessary instruments to provide reliable meteorological data for the firing of the Honest John rocket in combat areas. First priority was to be focused on the fulfillment of accuracy requirements: namely, the development of instruments capable of providing a minimum of four spaced readings on wind speed and direction from the surface to the 350-foot level, with accuracy of ± 1 foot per second in velocity and $\pm 2^{\circ}$ in direction. Wind data above the 350-foot level, and temperature and pressure data for the surface and upper atmosphere, were to be furnished with the best available standard equipment. The weather station was to possess mobility and maneuverability characteristics equal to the self-propelled launcher and other rolling stock.[65]

(U) In consonance with decisions reached during a conference held on 4 February 1952, Signal Corps meteorologists approached the difficult instrumentation problem from two angles: (1) the assembly of an interim model for experimental purposes, and (2) a parallel study by the Evans Signal Corps Laboratory to determine the best practicable development item which might be acquired in the time allotted.[66] This effort culminated in the AN/MMQ-1 wind measuring set shown in the accompanying photograph.

(U) Following field tests of the interim experimental model, the Signal Corps Engineering Laboratories assembled six tactical prototypes of the wind measuring set by special arrangement with the Ordnance Corps. Joint engineering tests of the equipment, in the 1952 - 53 period, revealed a number of serious deficiencies, such as structural failure of the telescoping anemometer mast, defective oil seals, and erratic, unreliable wind data readings. The Signal Corps installed new

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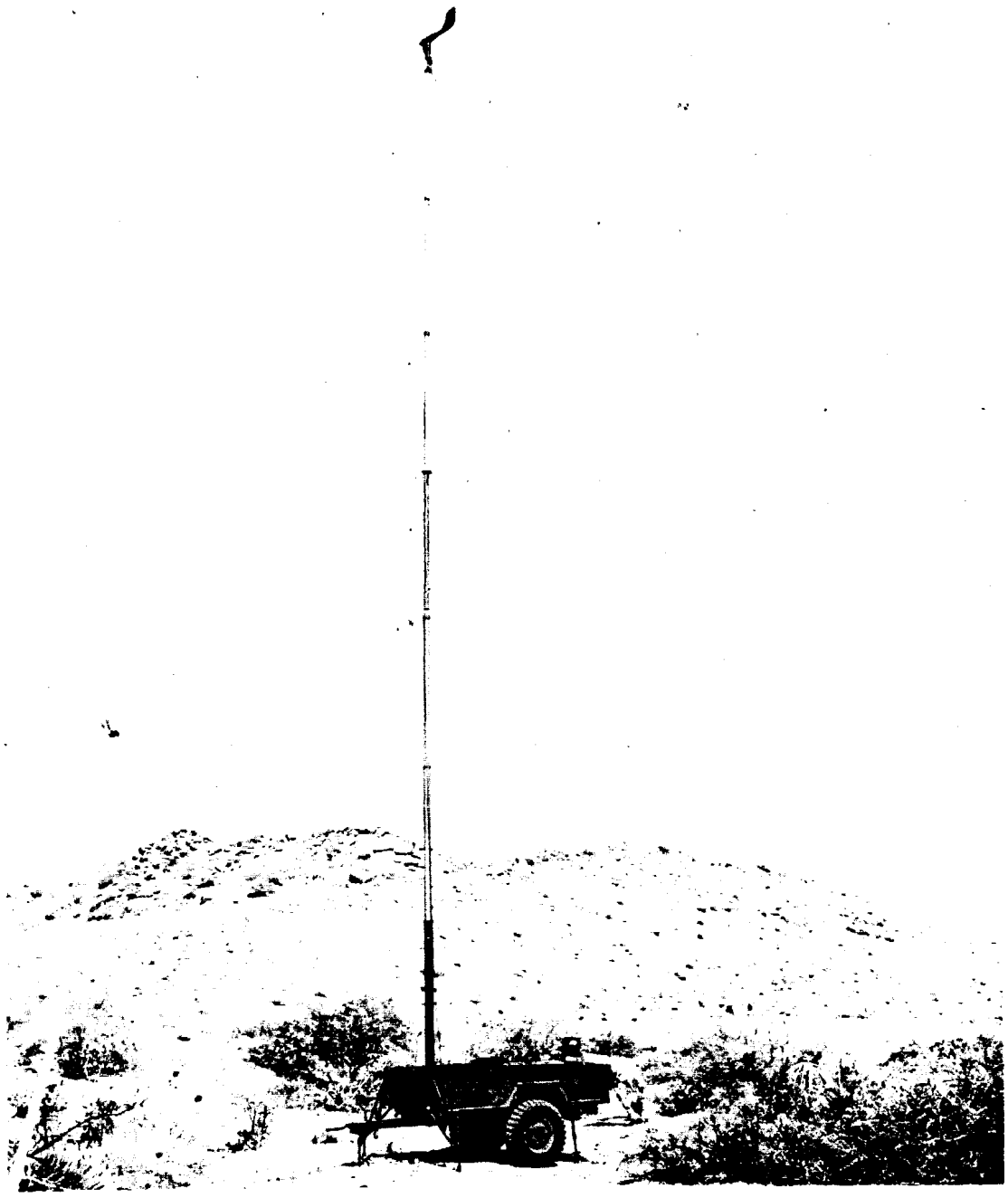
[65] DF, OO 471.94/876, CofOrd to CSigO, 28 Dec 51, sub: Met Info, Ord Proj TU2-1029, HJ, DA Pri 1A. ORDTU File, Dec 51 - Feb 52, MRB GSA FRC.

[66] (1) Cmt 2, OCSigO to CofOrd, 21 Mar 52, on DF cited in preceding footnote. ORDTU File, Mar 52 - Apr 52, MRB GSA FRC. (2) HJ Prog Rept, 1 Dec 51 - 29 Feb 52, RSA T&E Div. HJ R&D Case Files, Box 14-8, RHA AMSC.



AN/MMQ-1 Wind Measuring Set

[redacted]

chromium-plated masts with improved oil seals in the six prototype sets, and also in the 24 production sets being assembled at the Baltimore Signal Depot for issue to tactical units.[67]

(U) The improved mast eliminated major structural deficiencies in the equipment; however, the problem of obtaining reliable wind data at the desired level proved much more difficult and was yet unsolved a year after the first tactical units reached the field. The results of Honest John weapon system tests, conducted in the spring of 1954, indicated that the large dispersion errors stemmed directly from the lack of reliable wind information. An analysis of the test data revealed that the AN/MMQ-1 wind equipment could not give reliable surface wind information in the region up to burnout (about 3,000 feet). Consequently, wind corrections fed to the launcher were frequently in error and wide dispersion was inevitable.

(U) In April 1954, the Chief of Ordnance learned that Signal Corps meteorologists knew very little about wind action in the region from about 200 feet to 3,000 feet—this representing the approximate region from launch to burnout where the free rocket is the most susceptible to wind and other factors affecting dispersion. The Signal Corps was expediting research to gain more knowledge in this area; but it would be several years before sufficient data could be accumulated to fully solve the wind measurement problem.[68]

(U) Pending the development of a final solution to the problem, the Army Field Forces requested that the AN/MMQ-1 equipment, with certain modifications, be classified as substitute standard and that a limited number be procured to meet the immediate requirement for accurate

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[67] (1) Mary T. Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," (2 vols. & suppl, RSA, 1 July 1954), II, 227 - 29. (2) DF, OCSigO to CofOrd, 21 Jan 54, sub: Wind Meas Set AN/MMQ-1; Incl thereto, DF, Chf, Engr & Tech Div, to Chf, P&D Div, OCSigO, 24 Aug 53, sub: same. ORDTU File, Jan - Feb 54, MRB GSA FRC.

[68] Ltr, 00/4C-8229, CofOrd to CG, RSA, 20 Apr 54, sub: Dispersion Reduction, 762mm Rkt, M31, (HJ). ORDTU File, Mar 54 - May 54, MRB GSA FRC.

[redacted]

measurement of low level winds. In October 1954, the Deputy Chief of Staff for Logistics notified the Chief Signal Officer that the AN/MMQ-1 wind measuring set, as modified to include an improved averager, was acceptable for interim tactical use, and directed that sufficient quantities be procured to meet established user requirements.[69]

(U) Subsequent field and laboratory tests of the modified unit, in late 1954, disclosed a number of new deficiencies which rendered the equipment unfit for field use. Aside from nine general deficiencies noted in field tests at Fort Sill, Oklahoma, the Chief of the Army Field Forces reported that laboratory tests had shown the averaging-type instrument panel to be unsatisfactory in several important respects.

(U) One of the main weaknesses noted concerned the time required to attain a full scale reading. For example, in the case of a 1-mile-per-hour wind, it took 3.6 minutes for the averager to attain 63 percent of full scale reading, and about 10 minutes to attain a full scale reading. The time required to attain the partial reading naturally varied according to wind velocity, but the time to attain a full scale reading remained substantially constant at 10 minutes. In practice, this meant that correction factors fed to the launcher would be based on the average value of winds which passed 10 minutes before launch time. Another weakness noted was the high sensitivity of the panel—for example, laying a hand on the instrument cabinet caused the value of corrections to vary from 5 to 35 mils. In addition, the averager was difficult to zero and would drift as much as 20 mils in one hour.[70]

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[69] 1st Ind, DCSLOG, DA, to CSigO, 19 Oct 54, on Ltr, OCSigO to ACofS, G-4, 27 Aug 54, sub: Wind Meas Set AN/MMQ-1 for HJ. ORDTU File, Sep 54 - Dec 54, MRB GSA FRC.

[70] (1) 1st Ind, OCAFF, to DCSLOG, 29 Nov 54, on Ltr, Hq, AFF Bd 1, Fort Sill, Okla, to OCAFF, 28 Oct 54, sub: Deficiencies of Wind Meas Set, AN/MMQ-1. (2) 4th Ind, OCAFF to ACofS, G-3, 16 Dec 54, on Ltr, OCSigO to ACofS, G-4, 27 Aug 54, sub: Wind Meas Set AN/MMQ-1 for HJ. Both in ORDTU File, Sep 54 - Dec 54, MRB GSA FRC.

(U) Some of the reported deficiencies were ultimately eliminated through modification of interim tactical equipment; others posed complex problems beyond the current state of the art, and therefore were carried over to, and became a part of, the Honest John Improvement Program which began in 1955.[71]

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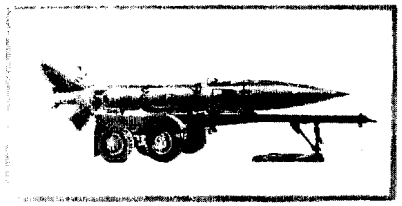
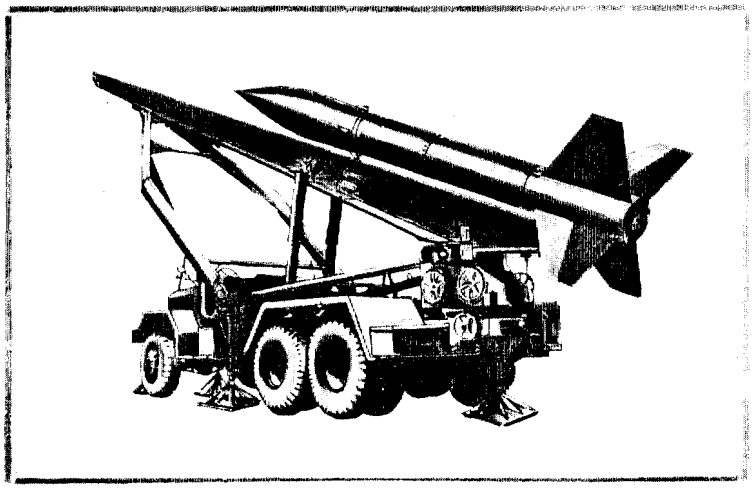
[71](1) DF, 00/4C-26110, CofOrd to OCSigO, 10 Dec 54, sub: Deficiencies of Wind Meas Set AN/MMQ-1. ORDTU File, Sep - Dec 54, MRB GSA FRC. (2) HJ Blue Book, pp. 47, 49.

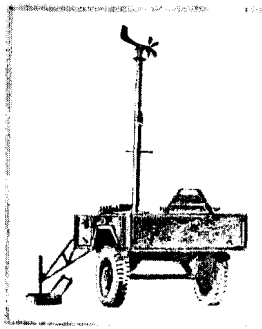
LAUNCHER M-289
(762 MM ROCKET, TRUCK MOUNTED)
& ANCILLARY EQUIPMENT



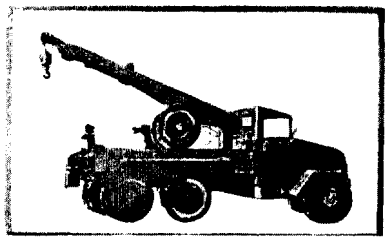
TRAILER, M-329



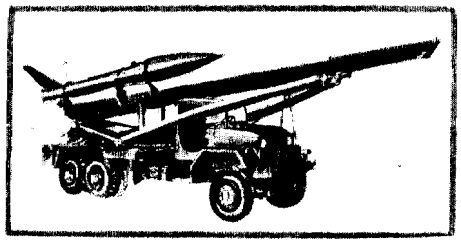
LAUNCHER M-289, 762 MM ROCKET
(WITH ROCKET IN FIRING POSITION)



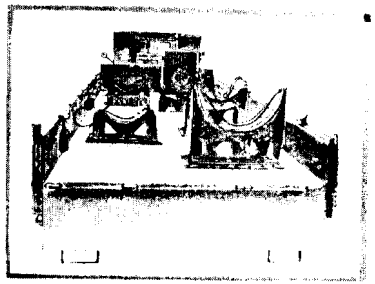
WIND SET, HEAVY DUTY
AN/MMQ-1



WRECKER, M-62



LAUNCHER WITH ROCKET IN TRAVEL POSITION



M-55 TRUCK
WITH HEATING & TIEDOWN KIT

CHAPTER VIII

(U) PARALLEL LAUNCHER DEVELOPMENT PROGRAM (U)

(U) The Ordnance Corps, it will be recalled, initiated the parallel launcher development program in April 1952, at the direction of the Army Chief of Staff. General Collins established the requirement for such a program on 10 April 1952, after observing an Honest John firing at the White Sands Proving Ground. He stated that the many tactical applications of the rocket pointed to the need for other types of launchers to supplement the self-propelled, truck-mounted type being developed at Rock Island. In addition to the need for developing a lightweight, air-transportable launcher, he said that work should be started on a towed-type launcher, the idea being that several rockets could be towed into firing position by one prime mover, while the truck-mounted launcher could carry only one rocket.[1]

(U) Conducted under the technical supervision of the Redstone Arsenal and carried on a noninterference basis with the self-propelled launcher project, the program was primarily concerned with engineering design and feasibility studies of several alternate launchers for possible use with the Basic Honest John System. Specifically, it embraced (1) a semitrailer-type launcher, developed by the Douglas Aircraft Company, (2) an alternate full-trailer type, designed by the American Machine and Foundry Company, (3) an expendable 1-shot launcher, designed by the ACF-Brill Motors Company, and (4) a lightweight version of the XM-289 self-propelled launcher, built by the Rock Island Arsenal.

(U) For reasons which will become obvious presently, these innovations failed to meet the tactical requirements of the Basic Honest John Weapon System, and the entire program was eventually abandoned. Effort at the Douglas Aircraft Company and the Rock Island Arsenal ended with

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[1](1) HJ Blue Book, p. 15. (2) Ltr, CofOrd to CO, RSA, 14 Apr 52, sub: Lchr for HJ Rkt, Proj TU2-3008, DA Pri 1A. HJ R&D Case Files, Box 14-90, RHA AMSC.

the fabrication and test of one prototype model; the other two projects never got past the feasibility study stage.

(U) Evolution of the Semitrailer-Mounted Launcher (XM-290) (U)

(U) The first phase of the abortive effort to provide a trailer-mounted launcher for the Honest John began in April 1952 and ended 2 years later with a total expenditure of well over a quarter of a million dollars. On 14 April 1952, the Chief of Ordnance charged the Redstone Arsenal with responsibility for technical supervision of the development program, and directed that the work be carried out "in the most expeditious manner." Research and development funds totaling $270,000 had been allocated for this purpose earlier in the month.[2]

(U) The Arsenal awarded this assignment to the Douglas Aircraft Company, the prime contractor for Honest John rocket development under Project TU2-1029. Item II of Supplemental Agreement No. 8, dated 16 June 1952, called for the design, fabrication, and delivery of one prototype trailer-mounted launcher; participation in engineering work necessary to incorporate desirable design changes; and conversion of the design to Ordnance-type drawings and specifications. The estimated cost of this work amounted to $262,514, leaving the Redstone Arsenal $7,486 for administrative overhead and contingencies.[3]

(U) The Douglas Aircraft Company completed the preliminary drawings of the proposed launcher design within 3 weeks after signing the contract; but final approval of the drawings for fabrication of the prototype launcher was not forthcoming for nearly 4 months. The proposed tactical design, presented during a conference at the contractor's plant on 8 July, featured a folding-type launching rail with 25 feet of guidance instead of the 30-foot guidance length established for the self-propelled

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[2] Ibid.

[3] (1) Ibid. (2) Ltr, LAOD, thru CofOrd, to ACofS, G-4, 23 May 52, sub: Req for Appr of Awd of Suppl Agmt to Enlarge the Scope of Work & Inc the Est Cost & Fxd Fee of Contr No. DA-04-495-ORD-22, DAC. HJ R&D Case Files, Box 14-8, RHA AMSC. (3) HJ Blue Book, pp. 8, 15.

launcher. Realizing that the reduced guidance length would probably have an adverse effect on rocket dispersion, Ordnance Corps representatives withheld approval of the design pending submission of more information in support of the proposal.

(U) In response to this decision, the Douglas Aircraft Company submitted a letter report, on 11 July, delineating both the advantages and disadvantages of the shorter rail length. On the positive side, the contractor pointed out that the reduced rail length offered important advantages in design simplicity and field utility. The changes necessary to incorporate a 30-foot rail in the proposed design, he noted, would increase the overall weight by about 4,500 pounds and adversely affect the mobility of the weapon. On the negative side, the reduced guidance length would probably increase the lateral dispersion of the rocket by a maximum of 1.0 mil over the tactical dispersion value of 10.5 mils expected with the self-propelled launcher. In addition, the 25-foot guidance length would possibly introduce a launcher clearance problem for rocket firings at 0°F. because of the greater gravity drop of the missile at low temperature. However, the contractor indicated that the additional clearance required was so small that the problem could be readily solved by redesign of the launcher rail.[4]

(U) Because of the potential clearance problem in low temperature firings, design approval was again withheld pending further study to define more clearly the nature and scope of required changes.[5] The Chief of Ordnance finally approved the 25-foot rail design for the towed, semitrailer launcher on 30 October 1952.[6] By the end of December, prints of the final design drawings had been released and fabrication of

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[4] Ltr, DAC to CofOrd, 11 Jul 52, sub: Shorter Lchr Guidance Length for Model 1236F. HJ R&D Case Files, Box 14-90, RHA AMSC.

[5] Ltr, CG, RSA, to CofOrd, 30 Jul 52, sub: Lchg & Hdlg Equip - HJ Proj TU2-3008, DA Pri 1A; and Incl 1 thereto, "Analysis of the Launcher Guidance Length for the Honest John Rocket," 24 Jul 52. HJ R&D Case Files, Box 14-90, RHA AMSC.

[6] 1st Ind, CofOrd to CG, RSA, 30 Oct 52, on ltr cited in foregoing footnote. HJ R&D Case Files, Box 14-90, RHA AMSC.

the prototype launcher was under way at the Consolidated Western Steel Corporation, Santa Monica, California.[7]

(U) The trailer-mounted prototype launcher, designated as the XM-290, underwent vigorous shakedown test at Santa Monica, in May 1953, and arrived at the White Sands Proving Ground, on 17 June, for use in comparison tests with the XM-289-2 self-propelled launcher.[8] The Chief of Ordnance had insisted, in November 1952, that the schedule "be expedited to effect an earlier delivery date [than May 1953] in order that comparative tests may be performed . . . as soon as possible."[9] But the contractor was apparently unable to improve the schedule; and, indeed, the equipment actually arrived at the proving ground several weeks later than originally planned. This was just as well, for a higher priority firing program interfered with the test schedule and formal emplacement firings from the launcher did not begin until August 1953—some 8 weeks after the delivery of the equipment.[10]

(U) Beginning on 17 August and continuing through 10 December 1953, the test crew at White Sands fired six Honest John rockets from the XM-290 launcher.[11] Performance of the launcher in these tests was disappointing in several respects, but particularly so in the broad areas of stability and construction ruggedness. In each of the firings, the rocket back blast caused the launcher to jump about 18 inches. The Douglas Aircraft Company attempted to correct this deficiency with a

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[7]Monthly Prog Repts, Proj TU2-3008, Dec 52 and Jan 53. HJ R&D Case Files, Boxes 14-90 and 14-8, RHA AMSC.

[8]Monthly Prog Rept, Proj TU2-3008, May 53; Qtrly Prog Rept, Jun - Aug 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

[9]Ltr, CofOrd to CG, RSA, 18 Nov 52, sub: HJ Projs TU2-1029 & TU2-3008. ORDTU File, Nov 52 - Dec 52, MRB GSA FRC.

[10]Monthly Prog Rept, Proj TU2-3008, Jun 53; Qtrly Prog Rept, Jun - Aug 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

[11]"Summary of Honest John Data (OIO Grain)," atch as Incl to Ltr, CG, WSPG, to CofOrd, 10 Mar 54, sub: HJ Rkt Data. ORDTU File, Mar 54 - May 54, MRB GSA FRC.

blast deflector, but without success.[12] In the last firing, the left rear launcher jack failed because of a break in the cast iron housing.[13]

(U) Road tests of the trailer-mounted launcher, conducted at the Aberdeen Proving Ground early in 1954, indicated the need for improved mobility. For example, heavy weight and poor roadability made it impractical for any existing prime mover to pull more than one such launcher at a time. The lack of traction on hills was equally disturbing.[14]

(U) Recognizing that the trailer-mounted launcher offered no significant improvement over the self-propelled design, the Chief of Ordnance withdrew the requirement for a trailer-type launcher, in April 1954. Accordingly, the White Sands Proving Ground terminated all tests and modifications, and placed the XM-290 launcher in storage.[15]

(U) Alternate Study of Trailer-Type Launcher

(U) In August 1952, while final approval of the semitrailer launcher design was still being debated, the Chief of Ordnance directed the Redstone Arsenal to obtain an alternate engineering study of a trailer-type launcher from another source.[16] Five months later, the Arsenal selected the American Machine and Foundry Company to conduct an engineering study of a full-trailer type launcher, and sent the New York Ordnance District $25,000 for the execution of a cost-plus-fixed-fee contract.[17] The District completed the negotiation of a contract for

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[12] Monthly Prog Repts, Proj TU2-3008, Sep 53 & Dec 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

[13] TT ORDBS-STD-12-289, CG, WSPG, to CofOrd, 11 Dec 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

[14] (1) HJ Blue Book, pp. 15 - 16. (2) Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," II, 230.

[15] Monthly Prog Rept, Proj TU2-1029, Apr 54. ORDTU File, Mar 54 - May 54, MRB GSA FRC.

[16] Ltr, CofOrd to CO, RSA, 20 Aug 52, sub: Engr Study on Tlr Type Lchr. HJ R&D Case Files, Box 14-90, RHA AMSC.

[17] Ltr, CG, RSA, to Dist Chf, NYOD, 5 Jan 53, sub: Engr Study on Tlr Mounted Lchr for HJ Rkt. HJ R&D Case Files, Box 14-8, RHA AMSC.

$24,320, in late March 1953.[18]

(U) The American Machine and Foundry Company proceeded with an analysis of the problem while contract negotiations were under way, and by late April 1953 had completed six preliminary design concepts for consideration. During a conference held at the Pentagon in May 1953, Ordnance Corps representatives selected for further engineering study a beam trailer design mounted on a suitable carriage for towing either as a semitrailer or as a full-trailer by emplacing a dolly.[19]

(U) The contractor completed the feasibility study of this design in July 1953 and submitted the final study report in late August. An evaluation subsequently made by the Redstone Arsenal Technical & Engineering Division resulted in the conclusion that further development of the proposed launcher should not be considered, since it offered no marked advantage over the trailer-mounted type designed by the Douglas Aircraft Company.[20] However, the Chief of Ordnance decided that there were enough different features in the proposed launcher to "possibly justify the completion of engineering and production of a prototype," and that the proposal should be presented for consideration by the Army Field Forces and the General Staff. To pursue the program, about $147,300 would be needed to complete engineering, and $75,000 to $100,000 for the manufacture of a prototype.[21]

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[18]Contract DA-30-069-ORD-1074 signed on 25 March 1953. HJ Blue Book, p. 151.

[19]Monthly Prog Repts, Proj TU2-3008, Apr 53 & May 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

[20](1) Qtrly Prog Rept, Proj TU2-3008, Jun - Aug 53. (2) 1st Ind, Dep Ch, T&E Div, OML, to Chf, Rkt Dev Div, OML, 26 Oct 53, on Memo, Act Chf, Rkt Dev Div, to Chf, T&E Div, 14 Sep 53, sub: Final Repts on ACF-Brill Study on HJ Lt Wt Expendable Lchr & AMFCo Study of HJ Tlr Mounted Lchr, and ACF-Brill Dwg of Expendable Lchr. Both in HJ R&D Case Files, Box 14-8, RHA AMSC.

[21]Min of HJ Lchr Conf at OCO, 15 Oct 53, atch to Tvl Rept by Pfc Roger C. Guarino, Rkt Dev Div, OML, 26 Oct 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

(U) Both the Army Field Forces and the General Staff promptly disapproved the proposal and all effort ceased with final payment to the contractor in November 1953.[22] The total expenditure under the contract amounted to about $22,266, some $2,054 of the original contract amount being recovered.[23] The cost of administrative overhead at the Redstone Arsenal and the New York Ordnance District probably increased the total cost of the program to some $25,000.[24]

(U) Engineering Design of the Expendable, 1-Shot Launcher

(U) The third phase of the parallel program officially began in June 1952, when the Chief of Ordnance authorized the Redstone Arsenal to initiate action for development of a lightweight, air-transportable, knock-down-type launcher capable of being assembled without the need for special tooling. The object of the program was to provide a means of launch emplacement in relatively inaccessible regions, such as could be made by helicopter delivery or comparatively light automotive equipment. Structurally, the launcher would have to be strong enough to support only one firing, and therefore would be considered an expendable item which might be reused or deserted, depending upon the combat situation.[25]

(U) By the end of July 1952, the Redstone Arsenal Technical & Engineering Division had completed a detailed outline of the requirements and design characteristics for such a launcher and solicited cost proposals from various sources through the Ordnance districts. The program plan consisted of four phases, the first one dealing exclusively with an engineering study and preparation of drawings suitable for fabrication

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[22] Cagle, "Design, Development and Production of Rockets and Rocket Launchers, 1946 - 1954," II, 225.

[23] HJ Blue Book, p. 151.

[24] Estimate based on trends in other similar programs; exact cost figures not available.

[25] Ltr, CofOrd to CO, RSA, 10 Jun 52, sub: Lt Wt Lchr for HJ Rkt, Proj TU2-3008, DA Pri 1A. HJ R&D Case Files, Box 14-90, RHA AMSC.

of a prototype.[26] A study of the competitive bids, received in late August 1952, led to the selection of the ACF-Brill Motors Company, of Philadelphia, whose proposal embraced a total cost estimate of $191,950 for the four-phase program. To carry out the planned program, an additional $23,050 would be required for Redstone Arsenal support, increasing the total estimated cost to $215,000. Funds initially supplied for the program amounted to $69,000.[27]

(U) In October 1952, the Arsenal sent the Philadelphia Ordnance District $44,180 for the negotiation of an R&D contract covering the Phase I engineering design study. The basic contract, awarded to the ACF-Brill Motors Company on 3 December 1952, amounted to $43,680 and called for completion of the engineering study by 31 March 1953.[28]

(U) The Phase I study progressed on schedule; and, as late as 19 March 1953, it appeared that the target date would be met with ease. During a meeting at the contractor's plant, on 10 March, a Redstone Arsenal representative had "reviewed in detail" the proposed launcher design which featured a 25-foot guidance length. On the basis of this review, the contractor had then built a one-eighth scale model of the launcher and presented it to Ordnance Corps officials during a meeting at the Pentagon on 19 March. Up to and including the latter review, there had appeared to be general agreement that the proposed launcher design would fulfill the established military requirements, and the contractor had proceeded with plans for a formal presentation to the Army Field Forces.

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[26] Ltr, CG, RSA, to Dist Chf, Chicago Ord Dist (same ltr to other dists), 29 Jul 52, sub: Ord Proj TU2-3008C, DA Pri 1A, Lt Wt Lchr for HJ Rkt; and Incl 1 thereto, Outline of a Prog to Design & Dev a Lt Wt Knock-Down Type Lchr & Hdlg Equip for the HJ Rkt, RSA T&E Div, 15 Jul 52. HJ R&D Case Files, Box 14-90, RHA AMSC.

[27] Ltr, CG, RSA, to CofOrd, 11 Sep 52, sub: Lt Wt Lchr for HJ Rkt, Proj TU2-3008, DA Pri 1A. HJ R&D Case Files, Box 14-90, RHA AMSC.

[28] (1) Ltr, Dist Chf, PHOD, to CG, RSA, 5 Dec 52, sub: Phase I Design Study of HJ Rkt [Contr DA-36-034-ORD-1148]. HJ R&D Case Files, Box 14-90, RHA AMSC. (2) Monthly Prog Rept, Proj TU2-3008, Jan 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

(U) But then came a frustrating, eleventh-hour decision that sent the design engineers back to their drawing boards. On 27 March, the contractor received word that the Office, Chief of Ordnance had issued a new directive requiring all launchers for the Honest John to be based on a 30-foot guidance rail. This radical, last-minute shift in technical guidance—no doubt resulting from experience with the XM-290 trailer-mounted launcher—rendered about half of the contractor's drawings and calculations obsolete, and set the engineering design effort back nearly a month. Because of this delay, the ACF-Brill Motors Company requested a 60-day time extension, with submission of the interim technical report by the end of May 1953.[29] A subsequent amendment to the contract extended the expiration date to 31 May 1953.[30]

(U) In late April 1953, the contractor held a meeting at Philadelphia to acquaint personnel of the Army Field Forces with the proposed design of the lightweight, expendable launcher. Though favorably impressed in a very general way, Lt. Col. M. W. Jennings, representing the Office of the Chief, Army Field Forces, pointed to several limitations which would be detrimental to field operation: namely, the lack of flexibility, the 3^{o} maximum traverse, and the excessive time and equipment necessary to emplace and aim the launcher. Another representative of the Field Forces explained that, as a tactical weapon, the launcher might be used to fire at short ranges down to 10,000 yards. This, he said, would require a minimum rail elevation of 10^{o}; whereas the proposed launcher had been designed for a 15^{o} minimum firing elevation. The obvious problem here was that the user had failed to establish a firm requirement for a short-range firing capability; and, consequently, the Ordnance Corps had not

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[29](1) Ltr, ACF-Brill Motors Co., to CG, RSA, 2 Apr 53, sub: Contr DA-36-034-ORD-1148RD, Ptbl Rkt Lchr, HJ. (2) Prog Rept No. 3, 31 Mar 53, ACF-Brill Motors Co. Both in HJ R&D Case Files, Box 14-8, RHA AMSC.

[30]The ACF-Brill Motors Company cited the amended expiration date in a letter to the Philadelphia Ordnance District, 18 May 1953, subject: Contract DA-36-034-ORD-1148 (RD), Portable Rocket Launcher, Honest John. HJ R&D Case Files, Box 14-8, RHA AMSC.

included such provisions in the engineering study contract, the latter calling for a minimum firing elevation of 15°.

(U) At the conclusion of the conference, the ACF-Brill Motors Company agreed to conduct further studies with a view toward increasing the maximum traverse from ±3° to ±10°, and reducing the minimum firing elevation from ±15° to ±10°. The company's design engineers pointed out, however, that there were no quick and easy solutions to these problems. The revised minimum rail elevation was of prime concern, partly because all the design drawings and calculations had been predicated on a 15° elevation, but mainly because of the complex conditions inherent in a lower firing elevation.[31]

(U) In addition to studies of these problems, the Redstone Arsenal later requested that the contractor investigate (1) the possibility of fabricating the first prototype with commercial aluminum rather than special, extruded aluminum, and (2) the feasibility of converting the expendable launcher to a self-propelled type by mounting it on a 2-1/2-ton, 6-by-6, standard truck chassis. To allow time for this added effort, the Arsenal extended the contract period to 30 June 1953.[32]

(U) The engineering study continued through May without interruption, but in the succeeding 2 months it came to a virtual standstill. The contractor's plant was crippled by a strike during most of June, resulting in another contract extension to 31 July 1953.[33] Then, on 7 July, the Contracting Officer issued a stop-work order which remained in effect through 22 July. The new work directive, issued on 23 July, called for completion of the engineering design study and submission of the final report, by 31 August, on both the expendable, ground-emplaced

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[31](1) Min of Mtg at ACF-Brill Motors Co., Philadelphia, Pa., 23 Apr 53. (2) Monthly Prog Rept, Proj TU2-3008, Apr 53. Both in HJ R&D Case Files, Box 14-8, RHA AMSC.

[32]Monthly Prog Rept, Proj TU2-3008, Jun 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

[33]Ibid.

launcher and the self-propelled, lightweight launcher.[34]

(U) Meanwhile, the Redstone Arsenal proceeded with plans to fabricate one prototype of the expendable, lightweight launcher, and actually supplied the Ordnance District $102,000 for that purpose in late May 1953. Under the supplemental contract agreement subsequently awarded, the ACF-Brill Motors Company promised to deliver one prototype of a greatly simplified launcher design by 31 October 1953, with one set of the final engineering drawings and 150 copies of "Notes on Development Type Materiel" to follow within 30 days. Additional R&D funds obligated for this effort (including an average fixed fee of 10 percent) amounted to $102,139.58: $83,005.52 for fabrication of the prototype and $19,134.06 for completion of engineering work.[35]

(U) The ACF-Brill Motors Company completed the basic engineering study and submitted the final report in August 1953. An analysis of the study report, by the Redstone Arsenal, indicated virtually no improvement over the self-propelled launcher developed by the Rock Island Arsenal. The 1-shot, portable launcher design still possessed the limitations previously noted by the Army Field Forces; and the system had not been simplified, as claimed by the contractor, a crane and an additional truck still being required for handling and transporting the rocket and launcher. An evaluation of the truck-mounted launcher study revealed that the requirement for mounting the launcher on a 2-1/2-ton truck was neither practical nor feasible, in that the rocket alone—without any elevating, traversing, or supporting mechanisms—would

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[34](1) Ltr, ACF-Brill Motors Co., to CG, RSA, 26 Aug 53, sub: Contr DA-36-034-ORD-1148RD, Ptbl Rkt Lchr, HJ. (2) Min of Mtg at ACF-Brill Motors Co., 12 Aug 53. (3) Qtrly Prog Rept, Proj TU2-3008, Jun - Aug 53. All in HJ R&D Case Files, Box 14-8, RHA AMSC.

[35](1) Ltr, ACF-Brill Motors Co., to Dist Chf, PHOD, 18 May 53, sub: Contr DA-36-034-ORD-1148(RD), Ptbl Rkt Lchr, HJ. (2) Ltr, ACF-Brill Motors Co., to CG, RSA, 18 May 53, sub: Contr DA-36-034-ORD-1148. (3) Ltr, PHOD, to CG, RSA, 20 May 53, sub: ACF-Brill Motors Co., Contr DA-36-034-ORD-1148 - Proposal for Fab of Prototype. (4) Ltr, CG, RSA, to PHOD, 27 May 53, sub: ACF-Brill Contr ORD-1148 - Ptbl Rkt Lchr, HJ. All in HJ R&D Case Files, Box 14-8, RHA AMSC.

overload the vehicle. The evaluation team thus concluded that "neither launcher has sufficient advantages to justify a development program."[36]

(U) The Army and the Marine Corps promptly withdrew their support of the 1-shot, expendable launcher; and, in October 1953, the Redstone Arsenal revoked the funds ($102,139.58) which had been allotted for additional engineering effort and fabrication of the prototype.[37] With the cancellation of these funds, the net cost of the engineering study program, including Redstone Arsenal support, was about $69,000.[38]

(U) But the effort to develop a lightweight launcher did not end here. The Rock Island Arsenal immediately took up the challenge and attempted to develop a lightweight version of its self-propelled launcher, using an aluminum beam structure similar to the one resulting from the ACF-Brill expendable launcher study. Notwithstanding the withdrawal of support from the portable launcher, the Chief of Ordnance in November 1953, decided to continue the program, on the premise that the Army Field Forces "would support a self-propelled type of lightweight launcher. . . ."[39]

(U) (U) The Lightweight, Self-Propelled Launcher (XM-289E1) (U)

(U) In January 1954, the Rock Island Arsenal began work on a lightweight version of the XM-289 launcher (later to be designated as the XM-289E1), using the vehicle and parts from the XM-289-1 prototype.[40] In consonance with policy guidance issued by the Chief of Ordnance in

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[36] 1st Ind, Dep Chf, T&E Div, OML, to Chf, Rkt Dev Div, OML, 26 Oct 53, on Memo, Act Chf, Rkt Dev Div, to Chf, T&E Div, 14 Sep 53, sub: Final Repts on ACF-Brill Study on HJ Lt Wt Expendable Lchr ..., and ACF-Brill Dwg of Expendable Lchr. HJ R&D Case Files, Box 14-8, RHA AMSC.

[37] Qtrly Prog Rept, Proj TU2-3008, Sep - Nov 53. HJ R&D Case Files, Box 14-8, RHA AMSC.

[38] Exact cost figures not available.

[39] Ltr, CofOrd to CO, RIA, 12 Nov 53, sub: Aluminum Beam for HJ Rkt Lchr, Proj TU2-3008, DA Pri 1A. HJ R&D Case Files, Box 14-8, RHA AMSC.

[40] Johnson and Weston, "Development and Production of Rocket Launchers at Rock Island Arsenal, 1945 - 1959," II, 179 - 80.

March 1953,[41] the Arsenal engineers based their initial rail design on a 30-foot guidance length. The Douglas Aircraft Company had estimated that a reduced, 25-foot guidance length would increase rocket dispersion by about 1.0 mil over the 10.5 mils dispersion expected for the tactical XM-289 launcher.[42] However, the results of later tests, in the early fall of 1954, indicated that a 25-foot guidance length would increase dispersion by only 0.5 mil. The Commanding General of the Redstone Arsenal therefore recommended that the aluminum launching rail being developed for the lightweight system be based on the 25-foot guidance length.[43] As an alternative to the aluminum rail, the Rock Island Arsenal also built a shortened steel rail, the latter being designed to meet Phase III airborne requirements without removal of the launching beam.[44]

(U) Beginning in late April 1955, the XM-289E1 truck-mounted launcher underwent extensive tests at the White Sands Proving Ground, first with the steel rail and later with the aluminum rail. The design engineers soon discarded the aluminum beam structure, chiefly because of difficulties in preventing undue distortion from welding and heat-treating operations, and problems involved in joining steel to aluminum. The XM-289E1 launcher remained at the proving ground through 1956—presumably for further tests with the steel rail. In early 1957, the Ordnance Corps decided to abandon the program, and the White Sands Proving Ground shipped the launcher back to the Rock Island Arsenal.[45] The Arsenal later used a modified version of the XM-289E1 launcher in a

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[41](1) Ltr, ACF-Brill Motors Co., to CG, RSA, 2 Apr 53, sub: Contr ...·ORD-1148RD, Ptbl Rkt Lchr, HJ. (2) Prog Rept No. 3, 31 Mar 53, ACF-Brill Motors Co. Both in HJ R&D Case Files, Box 14-8, RHA AMSC. (3) See above, p. 209.

[42]See above, pp. 202 - 03.

[43]Ltr, CG, RSA, to CG, RIA, 21 Sep 54, sub: Ord Proj TU2-1029, Effect of Decreased Guidance Length. ORDTU File, Sep 54 - Dec 54, MRB GSA FRC.

[44]Johnson and Weston, op. cit., II, 179 - 80.

[45]Ibid., II, 180.

special project for the Air Force, but it, too, was soon terminated.[46]

(U) The available source material does not contain reliable cost data on the XM-289E1 program; however, judging from the scope and length of the program, the total expenditure probably exceeded the $102,139 which has been recovered from the cancelled ACF-Brill contract.

(U) Summary

(U) All told, the Government invested over a half million dollars in the parallel launcher development effort; but the designs evolving from the multilateral program offered little or no improvement over the XM-289 launcher. Generally speaking, the launchers were complicated, bulky, heavy, unwieldy, and structurally unreliable. However, the Ordnance Corps gained from the program a tremendous amount of technical knowledge in the form of comprehensive study reports and drawings, as well as much valuable technical data and experience in the limited field tests. Aside from this, the only tangible returns embraced two full-scale prototype launchers and one miniature model.

(U) Sooner or later, all of these benefits would be put to use and, perhaps, eventually pay for themselves. For example, the Air Force used the XM-289E1 prototype to good advantage, the total bill for necessary modifications amounting to only $61,000, in contrast to a much greater basic development cost. More importantly, the technical knowledge and experience gained with the reduced, 25-foot guidance rail ultimately led to the successful development of an even lighter, lower, and shorter launcher for the Improved Honest John Rocket System.[47]

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[46] Ibid., II, 182 - 83.

[47] Ibid., II, 182, 288.

CHAPTER IX

(S) THE BASIC HONEST JOHN WEAPON SYSTEM (U)

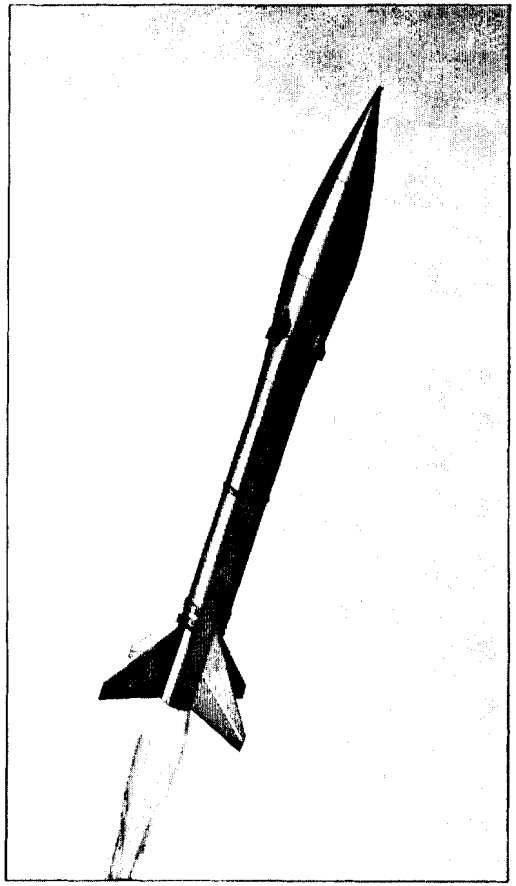
(U) The evolution of the Basic Honest John Weapon System has been traced from its inception in the heat of the Korean emergency, through the crash development and production of tactical hardware, thence to its deployment as an interim emergency weapon in 1954, and its subsequent design refinement in the product improvement phase. What then were the military characteristics of the combined weapon system that finally emerged from this latter effort? What were its tactical capabilities and limitations, and what was its expected life-span as a member of the Army's family of operational weapons?

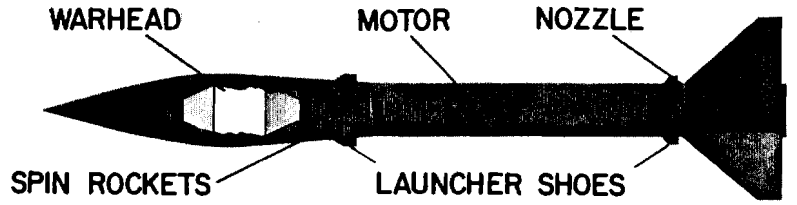
(U) Operational Characteristics of the Tactical System (U)

(U) The Basic Honest John System depicted in the accompanying chart is a surface-to-surface artillery rocket having a degree of air transportability. It provides the bulk of the Army's current capability for division and Corps nuclear fire support and contributes significant non-nuclear fire support. Unlike the more complicated guided missile systems, the Honest John is a free-flight rocket, unencumbered by electronic controls, simple in design, and simple to operate. Its range is equivalent to that of medium- to long-range artillery. Yet it has considerably more battlefield mobility than conventional artillery and one round can deliver on a target the demolition effect of hundreds of artillery shells.

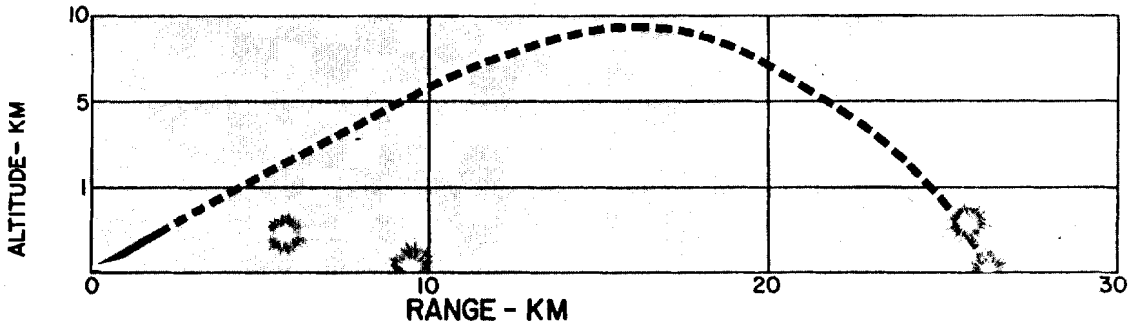
(U) The rocket itself comprises three separately packaged components: the head compartment (nose section); the motor (JATO and pedestal section); and the fin assembly. These components are so packaged to save money in shipping and to facilitate the sequence peculiar to different components. For instance, the motor must be sent to the Radford Arsenal for propellant loading, while the head compartment must go to one of the warhead agencies for warhead installation. Final assembly of the head and fins to the motor section takes place in the assembly area to the rear of the firing site.

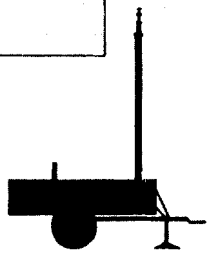
HONEST JOHN M31



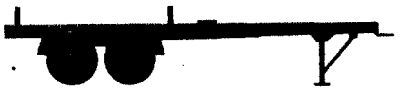


LENGTH - 327"
DIAMETER - 762 MM
WEIGHT - 5,900 LBS.
PAYLOAD - 1,500 LBS.
THRUST - 92,500 LBS.

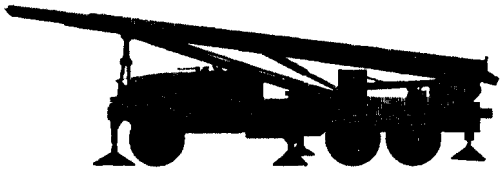




WIND SET
AN/MMQ-1



TRAILER
M-329



LAUNCHER
M-289

CONFIDENTIAL

ABMA

(U) Once assembled, the 27-foot rocket is transferred, by means of a medium wrecker, to the self-propelled launcher and transported to the launching site where it is aimed and fired in much the same manner as a conventional artillery gun. Designed for rugged, cross-country travel, the self-propelled launcher vehicle can safely transport a rocket on its rail during movement. The rocket can be driven to the launch site, elevated to the appropriate launch angle, and fired within 30 minutes' time. The launcher vehicle can then leave the launch site in a matter of minutes, thus avoiding enemy counterfire.[1]

(U) Within the operational capabilities just described, the Basic Honest John Weapon System was considered a tactically acceptable system and a valuable addition to the Army's family of atomic fire support weapons. But in the haste to provide an early operational capability, certain known shortcomings in system design had to be overlooked in favor of expeditious development. As a result, the performance capabilities of the tactical weapon system failed to measure up to the desired military standards in three important respects: maximum and minimum range, delivery accuracy, and operating temperature range. Table 4 compares the desired military characteristics with actual system performance capabilities in these three areas.

(U) In addition to the need for improvements in the aforementioned areas, design refinements were required in the rocket, launcher, and ancillary equipment to make the overall weapon system more suitable for field use. The design changes necessary to achieve the desired performance capabilities were incorporated in the Improved Honest John Weapon System.[2]

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[1](1) Maj Gen Earle G. Wheeler, "Missiles on the Firing Line," Army Information Digest, 11 (Dec 56), pp. 42 - 43. (2) DOD Press Release No. 347-54, Honest John, 17 Apr 54. ORDTU Files, Mar - May 54, MRB GSA FRC. (3) HJ Blue Book, p. 32.

[2]See Mary T. Cagle, "History of the Improved (M50) Honest John Weapon System, 1955 - 1964" (monograph in preparation).

Table 4—(U) Military Characteristics vs Performance (U)

Military Characteristics (OCM 34490, 20 Nov 52)	Weapon System Performance Capabilities (OCM 37143, 6 Aug 59)
Maximum Range: 30,000 yards with all types of warheads is required. Minimum Range: 10,000 yards is acceptable.	Maximum Effective Range: 25,000 yards. Minimum Effective Range: 15,000 yards.
Accuracy shall be the maximum practical. A circular probable error not to exceed 200 yards is highly desirable.	Range / Range Accuracy / Deflection Accuracy 25,000 yards / 200 yards / 380 yards 20,000 yards / 135 yards / 275 yards 15,000 yards / 90 yards / 200 yards
Temperature Limits The rocket shall have built-in characteristics to permit operation in an air temperature range from -25°F. to +125°F., & storage from -80°F. to +160°F.	Temperature Range: M6 Rocket Motor Firing - 0°F. to +120°F. Storage - 0°F. to +120°F.

(U) Surveillance and Stock Phase-Out of M31 Rockets (U)

(U) In the early fall of 1961, less than a year after the cessation of production, close surveillance of the M31 rocket motor became a matter of major concern, for a large inventory of these motors would soon pass beyond their useful storage life. From studies conducted during the first half of 1961, the Army Ballistic Missile Agency[3] concluded that the serviceable life of M31 rocket motors was 6.5 years (from date of manufacture) for unrestricted use, but those up to 7.5 years of age would be suitable for use in a combat emergency or in firings where accuracy was not a requirement. On the basis of this tentative 6.5-year limit, the agency determined, in early September 1961, that the M31

[3] Commodity management responsibility for the Honest John and certain other weapon systems had been transferred from the Army Rocket & Guided Missile Agency to the Army Ballistic Missile Agency in the AOMC mission realignment of 1 August 1960 (AOMC GO 59, 27 Jul 60). On 11 December 1961, both of these agencies were abolished and their functions absorbed into the AOMC headquarters (DA GO 47, 26 Dec 61). After 31 July 1962, the Army Ordnance Missile Command was known as the Army Missile Command (MICOM GO 5, 30 Jul 62).

Honest John rocket would remain in service through June 1966, at which time some 1,650 motors—representing a total investment of about $13.2 million—would presumably become unserviceable. Concurrently, a number of tactical warheads—valued at more than $26 million—would also become obsolete, since several different types had been designed exclusively for the M31 rocket and were not interchangeable with the Improved XM50 Rocket.

(U) To recover the potential losses in excess warhead sections, the Commanding General of the Army Ordnance Missile Command considered several possible courses of action: (1) resumption of M31 rocket production, (2) conversion of M31 warheads to make them compatible with the XM50 rocket, and (3) extension of the rocket motor shelf-life beyond the 6.5-year limit. The resumption of M31 production was not considered feasible, mainly because the Radford Arsenal was then loading XM50 Honest John, Nike Hercules, and Littlejohn motors at maximum plant capacity and new propellant loading and manufacturing facilities would be required for additional production. An investigation of the warhead conversion approach disclosed that it would be feasible to modify one of the conventional warheads to be compatible with the XM50, but conversion of other conventional types would not be worthwhile. In the final analysis, the best solution to the M31 serviceability problem appeared to lie in the conversion of the best conventional warhead and the extension of the rocket motor shelf life.[4]

(U) Pending receipt of firm guidance on the proposed warhead conversion program, the Army Ballistic Missile Agency proceeded with static and flight tests of over-age M31 motors to determine whether or not the 6.5-year storage limit could be extended without significant effects on

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[4](1) DF, Chf, ABMA Control Ofc, to Dep CG, AOMC, 7 Sep 61, sub: Fact Sheet - Excess M31 HJ Whd Sections Due to Loss of Vehicles thru Over-Age Unserviceability. (2) Ltr, CG, AOMC, to CofOrd, 19 Sep 61, sub: Compatibility of the M6 & T2043 Warheads with the XM50 HJ Rkt. (3) Semiannual Historical Summary, Army Ballistic Missile Agency, 1 Jul - 11 Dec 61, by James M. Grimwood, pp. 118, 122 - 26.

system accuracy and reliability.[5] The latter program provided the ultimate solution to the motor serviceability problem. The results of test firings conducted on a continuing basis through November 1963 confirmed that the storage-life of the M31 rocket motor could be extended indefinitely with no degradation of system performance. However, continued surveillance and test firings would be required as long as the weapon system remained in the field.[6]

(U) Of the 5,023 M31 rockets delivered to the U. S. Army,[7] 1,693 remained in service as of 30 June 1963, the difference of 3,330 units representing losses through sales,[8] obsolescence, service practice firings, etc. In 1962, the M289 truck-mounted launcher and the M329A1 rocket transport trailer were replaced as Standard A by the improved M386 launcher and M405 handling unit; however, they were retained as limited standard items to meet requirements of the Military Assistance Program and other non-Army requirements.[9] The improved M386 launcher, M405 handling unit, and other items of ground equipment such as the XM33 air-transportable launcher were developed under the Honest John Improvement Program.[10]

(U) The Honest John Weapon System is expected to remain in the field through FY 1970. The phase-out of the Basic and Improved Systems at that time will depend on the availability of the Lance Missile System.[11]

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[5] Ibid., pp. 118, 126.

[6] TM 9-1340-202-12, Change 4, 15 Oct 63, p. 56.

[7] See total production and allocation data, page 154.

[8] To the Air Force, National Aeronautics & Space Administration, Defense Atomic Support Agency, and Atomic Energy Commission and, under the Military Assistance Program, to NATO countries.

[9] (1) Army Materiel Plan - FY 63 - 70, Vol III (RCS CSGLD-1138), Feb 64 (draft), pp. 228, 230. Plans Div Files, Compt & Dir of Programs, MICOM. (2) OCM 38118, 13 Aug 62. RSIC.

[10] See Mary T. Cagle, "History of the Improved (M50) Honest John Weapon System, 1955 - 1964" (monograph in preparation).

[11] Army Materiel Plan, Aug 63, pp. 258, 264, 268, 272, 276, 284, 288, 292, 296, 300, 306, 310, 314. HJ/LJ Commodity Ofc files, AMICOM.

Originally known as Missile "B," the Lance Missile System is to be simple, rugged, and reliable in order to operate in all areas and under all climatic conditions in which the Army operates. The Army Missile Command let the initial system development contract for the Lance to Ling-Temco-Vought, Inc., in January 1963. Existing Army plans call for initial tactical deliveries in FY 1968. It will replace not only the Honest John, but also the Lacrosse system and possibly the Littlejohn.[12]

[12](1) Semiannual Historical Summary, Headquarters Army Ordnance Missile Command, 1 Jan - 30 Jun 62, by Helen Brents Joiner, p. 45. (2) Annual Historical Summary, Army Missile Command, 1 Jul 62 - 30 Jun 63, by Helen Brents Joiner and John W. Bullard, p. 87.

APPENDIX A

E X T R A C T

DOUGLAS AIRCRAFT COMPANY
REPORT NO. SM-18650

FINAL FLIGHT TEST REPORT FOR HONEST JOHN ROUNDS 1 THROUGH 193 (U)

by

C. D. Day

and

L. Czarnowski

Prepared under contract to U. S. Army
Ordnance Department Contract No. DA-04-495-ORD-22

Aerodynamics Group
Douglas Aircraft Company, Inc.
Santa Monica, California

May 11, 1955

TABLE I. HONEST JOHN DATA SUMMARY CHART (OV GRAIN)*

Rd. No.	Firing Date	Msl Type	Motor Source	Payload	Fuze	R&D Lchr No.	Lchr QE (mils)	Surface Wind Range (mph)	Surface Wind Cross (mph)	Ground Impact Range (yds) Actual	Ground Impact Range (yds) Stripped	Ground Impact Deflection (yds) Actual	Ground Impact Deflection (yds) Stripped	Remarks
1	29 Jun 51	I	K-A	BAL	FRK	1	399	2.0 S	0.3 E	22,495	21,074	5 W	159 W	SR + 1.5° Fin Cant
2	18 Jul 51	I	K-A	BAL	FRK	1	399	0	0	21,648	20,622	189 W	137 W	SR + 1.5° Fin Cant
3	25 Jul 51	I	K-A	BAL	FRK	1	399	0.5 N	0.1 W	21,749	20,320	12 E	9 W	SR + 1.5° Fin Cant
4	1 Aug 51	I	K-A	BAL	PIC	1	399	1.5 N	0	21,453	20,185	124 W	134 W	SR + 1.5° Fin Cant
5	7 Aug 51	I	K-A	BAL	FRK	1	398	0.2 S	1.5 E	21,738	20,345	227 E	40 E	SR + 1.5° Fin Cant
(6	17 Oct 51	I	K-A	BAL	FRK	1	396	7.1 N	3.6 E	20,431	19,710	379 E	54 W	No SR Installed; 0.5° Fin Cant
(7	17 Oct 51	I	K-A	BAL	FRK	2	396	7.0 N	3.9 E	20,503	19,719	279 E	180 W	No SR Installed; 0.5° Fin Cant
8	24 Oct 51	I	K-A	BAL	FRK	1	396	4.6 N	2.2 E	21,019	20,068	234 E	29 W	Reverse Spin; SR + 0.5° Fin Cant
9	24 Oct 51	I	K-A	BAL	FRK	2	396	--	--	12,746	--	787 W	--	Reverse Spin. Nose Failure
(10	14 Nov 51	I	K-A	BAL	FRK	1	401	1.3 N	25.5 W	21,228	20,127	2181 W	345 W	Spin Rocket Not Ignited
(11	14 Nov 51	I	K-A	BAL	FRK	2	400	0.5 S	27.9 W	21,271	20,149	2205 W	158 W	
(12	28 Nov 51	I	K-A	BAL	FRK	2	400	0.9 S	0.3 E	22,001	20,759	198 W	47 E	
(13	28 Nov 51	I	K-A	BAL	FRK	1	401	0.9 S	0.5 E	21,796	20,394	398 E	233 E	
(14	17 Dec 51	I	K-A	BAL	FRK	2	400	4.8 S	18.1 W	21,810	20,520	1531 W	394 W	
(15	17 Dec 51	I	K-A	BAL	FRK	1	401	6.8 S	12.8 W	21,430	19,750	1217 W	530 W	
(16	4 Jan 52	I	K-A	BAL/SAN-T	FRK	2	400	0	0	21,092	19,963	167 E	40 W	
(17	4 Jan 52	I	K-A	BAL	FRK	1	401	0	0	21,507	20,247	144 E	64 W	
18	9 Jan 52	I	K-A	BAL/SAN-T	FRK	2	399	--	--	12,700	--	180 E	--	Nose Failure
19	9 Jan 52	I	K-A	BAL	FRK	1	401	20.0 N	3.1 E	20,103	21,022	217 E	110 W	
(20	11 Feb 52	I	K-A	BAL	FRK	2	399	7.0 N	14.5 W	20,944	20,272	1020 W	133 W	
(21	11 Feb 52	I	K-A	BAL	FRK	1	401	14.0 N	13.0 W	20,750	20,594	1019 W	222 W	
(22	11 Feb 52	I	K-A	BAL/T	FRK	2	400	7.1 N	15.5 W	21,102	20,892	953 W	44 E	
(23	11 Feb 52	I	K-A	BAL	FRK	1	401	5.1 N	17.9 W	21,525	20,892	1211 W	43 E	
(24	27 Feb 52	I	K-A	BAL/T	None	2	400	0.2 S	0.2 W	21,406	20,274	271 E	148 W	
(25	27 Feb 52	I	K-A	BAL/T	None	1	401	0.6 S	0.3 E	21,434	20,278	404 E	20 E	
(26	31 Mar 52	I	K-A	BAL/T	FRK	2	398	1.0 S	26.8 W	20,730	19,958	1966 W	195 E	
(27	31 Mar 52	I	K-A	BAL	FRK	1	401	1.1 S	28.8 W	21,703	20,576	2122 W	148 E	Incomplete Operation of Spin Rockets
(28	10 Apr 52	I	K-A	BAL/T	FRK	2	890	10.0 N	10.3 E	29,641	26,901	2538 E	61 E	
(29	10 Apr 52	I	K-A	BAL/T	FRK	1	890	8.1 N	5.7 E	32,328	29,368	2978 E	1203 E	
(30	21 May 52	I	K-A	BAL/T	PIC	1	890	4.4 S	2.3 E	32,029	30,470	1602 E	81 E	Modified 25-foot Launcher Rail Guidance
(31	21 May 52	I	K-A	BAL/T	PIC	2	890	1.2 S	1.6 E	31,689	30,124	1540 E	252 W	Modified 25-foot Launcher Rail Guidance
32	29 May 52	I	K-A	SAN/T	SAN	1	890	4.5 N	2.8 W	23,280	21,564	250 W	187 W	Modified 25-foot Launcher Rail Guidance
33	29 May 52	I	B-A	SAN/T	SAN	1	399	6.2 S	5.2 W	22,648	20,333	464 W	65 W	Modified 25-foot Launcher Rail Guidance
34	12 Jun 52	I	B-A	SAN/T	SAN	1	399	2.4 S	0.4 E	22,894	20,603	100 E	131 E	Modified 25-foot Launcher Rail Guidance
35 - 38	--	--	--	--	--	--	--	--	--	--	--	--	--	OIO Grain - SEE TABLE II
39	7 Jul 52	I	K-A	SAN/T	SAN	1	399	8.4 S	4.8 E	23,870	21,459	688 E	234 E	Modified 25-foot Launcher Rail Guidance

*** EXTRACT - Table VII.**

UNLESS OTHERWISE SPECIFIED:
All fuzes for forward spotting charge detonation.
All motors have OV-type grain temperature conditioned at 77°F.
All missiles have spin rockets and +0.5° Fin Cant.
Launcher rail provides 30 feet of guidance.

CODE:
K-A.... Manufactured by M. W. Kellogg Co.; Loaded by Allegany Ballistics Laboratory.
B-A.... Manufactured by Burnham Corporation; Loaded by Allegany Ballistics Laboratory.
BAL.... Ballast, 1500 pounds.
(..... Denotes Ballistic Pair
SAN.... Sandia Corporation (Atomic Energy Commission), 1136 pounds.
FRK.... Frankford Arsenal
PIC.... Picatinny Arsenal
T..... Telemetry
SR..... Spin Rockets
E or W. East or West
N or S. North or South

TABLE II. HONEST JOHN DATA SUMMARY CHART (OIO GRAIN)*

HISTORICAL		MATERIEL					LAUNCH CONDITIONS				AIR BURST			GROUND IMPACT				MISCELLANEOUS
Rd. No.	Firing Date	Msl Type	Motor Source	Type Whd	Type Fuze	Grain Temp. (°F)	Lchr Type/No.	Lchr QE (mils)	Surface Wind Range (mph)	Surface Wind Cross (mph)	Distance Actual (yds)	Distance Stripped (yds)	Altitude Actual (ft)	Range Actual (yds)	Range Stripped (yds)	Deflection Actual (yds)	Deflection Stripped (yds)	REMARKS
35	17 Jun 52	I	B-A	BAL	None	77	R&D/2	399.0	0.5	9.0	--	--	--	20,231	18,778	905 E	261 E	
36	17 Jun 52	I	B-A	BAL	None	77	R&D/1	401.0	-1.5	10.7	--	--	--	20,632	18,986	870 E	100 E	
37	30 Jun 52	I	B-A	BAL	PIC-VT	77	R&D/2	400.0	0	0	--	--	--	20,347	19,035	192 E	190 E	
38	30 Jun 52	I	B-A	BAL	PIC-VT	77	R&D/1	401.2	0	0	--	--	--	20,960	19,652	111 W	96 W	
39																		OV GRAIN. SEE TABLE I.
40	23 Jul 52	I	B-A	SAN	GM	77	R&D/1	621.1	-10.1	0.6	--	--	--	26,349	24,079	30 E	96 E	
41	23 Jul 52	I	B-A	BAL	PIC-VT	77	R&D/2	623.6	-7.1	0.6	--	--	--	27,270	25,282	61 W	45 E	
42	28 Jul 52	I	B-A	SAN	GM	77	R&D/1	621.1	0	0	--	--	--	27,087	26,066	382 W	342 W	
43	28 Jul 52	I	B-A	BAL	PIC-VT	77	R&D/2	623.5	-0.2	0.7	--	--	--	26,192	24,757	388 E	394 E	
44	4 Aug 52	I	B-A	BAL	PIC-VT	77	R&D/2	266.6	--	--	--	--	--	13,667	--	36 E	--	
45	4 Aug 52	I	B-A	BAL	PIC-VT	77	R&D/1	266.6	--	--	--	--	--	13,155	--	124 E	--	
46	11 Aug 52	I	B-A	BAL	PIC-VT	77	R&D/2	892.7	3.8	2.4	--	--	--	29,322	27,554	157 E	106 W	
47	11 Aug 52	I	B-A	BAL	PIC-VT	77	R&D/1	887.8	0.7	-0.7	--	--	--	30,491	28,585	580 E	753 E	
48	20 Aug 52	I	B-A	SAN	GM	77	R&D/1	890.0	3.7	3.4	--	--	--	29,925	28,157	697 E	102 E	
49	20 Aug 52	I	B-A	BAL	PIC-VT	77	R&D/2	889.3	0	0	--	--	--	29,729	27,539	34 E	135 W	
50	10 Sep 52	I	B-A	BAL	FRK-VT	77	R&D/1	405.9	-5.9	4.2	--	--	--	19,695	18,223	304 E	101 W	(50-51) Launcher rail canted 5°.
51	10 Sep 52	I	B-A	SAN	GM-VT	77	R&D/1	405.9	-2.2	1.2	--	--	--	20,336	19,152	362 E	179 E	
52	17 Sep 52	I	B-A	SAN	GM	77	R&D/1	621.4	13.1	4.8	--	--	--	26,104	25,298	876 E	60 W	
53	26 Sep 52	I	B-A	SAN	GM	77	R&D/1	621.3	0	-2.0	--	--	--	27,245	25,929	110 W	255 E	Spin rkt malfunction.
54	3 Oct 52	I	B-A	BAL	FRK-VT	100	R&D/1	399.7	-5.1	6.1	--	--	--	20,437	18,938	438 E	108 W	
55	3 Oct 52	I	B-R	BAL	FRK-VT	100	R&D/2	399.7	-2.0	3.5	--	--	--	19,760	18,415	283 E	73 W	
56	15 Oct 52	I	B-R	BAL	FRK-VT	100	R&D/1	400.6	0	0	--	--	--	19,624	18,788	130 E	86 E	
57	15 Oct 52	I	B-A	BAL	FRK-VT	100	R&D/2	399.4	0	0	--	--	--	19,590	18,776	185 E	154 E	
58	17 Oct 52	I	B-R	BAL	FRK	100	R&D/1	890.0	8.2	-3.6	--	--	--	28,425	27,241	225 W	29 E	
59	17 Oct 52	I	B-R	BAL	FRK	100	R&D/2	889.6	3.6	-0.4	--	--	--	28,571	27,333	19 W	234 W	Spin rkt malfunction
60	29 Oct 52	I	B-R	SAN	FRK-VT	100	R&D/1	923.7	0	0	--	--	--	28,574	27,102	181 E	139 W	
61	29 Oct 52	I	B-R	SAN	FRK	100	R&D/2	892.7	-5.0	0.4	--	--	--	28,477	27,168	174 W	485 W	
62	7 Nov 52	I	B-R	SAN	FRK-VT	40	R&D/1	400.6	0.3	0.4	--	--	--	18,264	16,973	197 E	94 E	
63	7 Nov 52	I	B-R	SAN	FRK-VT	40	R&D/2	398.5	2.4	2.9	--	--	--	18,501	17,469	231 E	57 W	
64	19 Nov 52	II	B-A	IH	PIC	77	R&D/1	401.2	0	0	17,630	17,083	1,114	--	--	--	--	
65	20 Nov 52	II	B-A	PIC	PIC	100	R&D/1	620.1	3.1	2.0	--	--	--	25,154	23,888	190 E	195 W	
66	20 Nov 52	I	B-R	BAL	VT	100	R&D/2	623.1	5.6	0.9	--	--	--	25,553	24,503	54 E	209 W	
67	21 Nov 52	II	B-A	SAN	GM	77	R&D/1	401.2	-7.0	-2.9	--	--	--	20,851	19,044	54 W	62 W	Spin rkt malfunction
68	26 Nov 52	II	B-R	PIC	PIC	40	R&D/1	621.0	0.3	0.4	--	--	--	24,660	23,190	509 E	51 W	
69	26 Nov 52	II	B-A	PIC	VT	40	R&D/2	624.0	-0.2	0.5	--	--	--	25,494	24,348	447 E	134 W	
70	26 Nov 52	II	B-R	PIC	VT	40	R&D/1	401.5	-3.4	-0.3	--	--	--	19,499	18,486	102 E	4 E	
71	26 Nov 52	II	B-A	PIC	VT	40	R&D/2	399.5	-3.7	0.9	--	--	--	18,288	17,231	153 E	30 W	
72	3 Dec 52	II	B-A	SAN	GM	77	R&D/1	400.9	2.0	-9.6	--	--	--	19,621	18,840	617 W	57 E	
73	5 Dec 52	II	B-A	BAL	None	40	R&D/1	621.2	-6.6	-2.4	--	--	--	23,258	21,543	71 W	30 E	
74	5 Dec 52	II	B-R	BAL	None	40	R&D/2	622.2	-8.0	0.7	--	--	--	26,449	24,120	380 E	113 E	
75	15 Dec 52	II	B-R	MH	PIC	77	R&D/1	400.2	0.2	0	13,572	--	5,471	--	--	--	--	
76	15 Dec 52	II	B-R	MH	PIC	77	R&D/2	390.9	-0.5	-0.5	--	--	--	19,414	18,695	84 E	69 E	
77	19 Dec 52	II	B-R	SAN	GM	77	R&D/1	400.1	6.1	-5.5	--	--	--	20,432	19,679	280 W	78 E	
78	19 Dec 52	II	B-R	SAN	GM	77	R&D/2	400.5	7.6	-1.4	--	--	--	20,458	19,529	178 W	164 W	
79	5 Jan 53	II	B-R	IH	PIC	77	R&D/1	401.0	4.5	2.7	18,194	17,802	1,323	--	--	--	--	
80	12 Jan 53	II	B-R	BAL	VT	40	R&D/1	889.2	-0.3	-1.0	--	--	--	26,663	24,659	1559 W	2221 W	SRM - Fin hit launcher
81	12 Jan 53	II	B-R	BAL	VT	40	R&D/2	892.0	-2.0	0.4	--	--	--	29,180	26,729	583 E	289 W	
82	13 Jan 53	II	B-R	MH	PIC	77	R&D/2	622.3	-2.0	3.5	23,311	21,967	6,557	--	--	--	--	

* EXTRACT - Tables IA, IB, IIA, IIB.

TABLE II. HONEST JOHN DATA SUMMARY CHART (010 GRAIN) - Continued

HISTORICAL		MATERIEL					LAUNCH CONDITIONS				AIR BURST			GROUND IMPACT				MISCELLANEOUS
Rd. No.	Firing Date	Msl Type	Motor Source	Type Whd	Type Fuze	Grain Temp. (°F)	Lchr Type/No.	Lchr QE (mils)	Surface Wind Range (mph)	Surface Wind Cross (mph)	Distance Actual (yds)	Distance Stripped (yds)	Altitude Actual (ft)	Range Actual (yds)	Range Stripped (yds)	Deflection Actual (yds)	Deflection Stripped (yds)	REMARKS
83	16 Jan 53	II	B-R	SAN	GM	40	R&D/1	888.0	-3.8	-0.6	--	--	--	29,665	28,383	125 E	245 W	
84	16 Jan 53	II	B-R	SAN	GM	40	R&D/2	889.0	-4.0	0.6	--	--	--	29,510	28,531	276 E	256 W	
85	28 Jan 53	II	B-R	BAL	VT	40	R&D/1	888.0	5.5	4.0	---	--	--	27,668	26,656	536 E	275 W	
86	28 Jan 53	II	B-R	BAL	VT	40	R&D/2	891.6	4.1	2.9	--	--	--	27,765	26,688	685 E	139 W	
87	29 Jan 53	II	B-R	MH	PIC	77	XM-289/1	400.0	1.5	0.3	17,248	16,198	3,359	--	--	--	--	
88	11 Feb 53	I	B-R	BAL	None	77	XM-289/1	622.5	9.1	-4.2	--	--	--	24,477	23,949	797 W	899 W	
89	11 Feb 53	II	B-R	BAL	VT	100	R&D/1	621.6	-3.5	-19.7	--	--	--	24,645	23,642	1448 W	438 E	
90	11 Feb 53	II	B-R	BAL	VT	100	R&D/2	622.2	0.9	-15.6	--	--	--	24,638	23,716	1411 W	44 W	
91	11 Feb 53	II	B-R	BAL	None	77	XM-289/1	400.0	0	-17.0	--	--	--	19,368	18,461	774 W	241 E	
92	12 Feb 53	II	B-R	BAL	None	100	R&D/1	196.5	-11.6	3.1	--	--	--	10,015	8,769	88 E	6 W	Short-Range Firing
93	12 Feb 53	II	B-R	BAL	None	100	R&D/2	196.6	-14.8	-2.6	--	--	--	10,519	9,000	45 W	38 E	Short-Range Firing
94	13 Feb 53	II	B-R	BAL	None	77	XM-289/1	195.5	-0.3	2.0	--	--	--	7,882	7,425	208 E	84 E	Short-Range Firing
95	13 Feb 53	II	B-R	BAL	VT	100	R&D/1	195.2	10.9	2.4	--	--	--	8,418	7,371	46 W	124 W	Short-Range Firing
96	13 Feb 53	II	B-R	BAL	VT	100	R&D/2	196.6	0	0	--	--	--	9,017	8,620	270 E	268 E	Short-Range Firing
97	20 Feb 53	II	B-R	MH	PIC	77	XM-289/1	622.0	--	--	--	--	--	--	--	--	--	SRM - No Wind Data
98	25 Feb 53	II	B-R	BAL	None	77	XM-289/1	889.0	4.6	-0.3	--	--	--	30,133	27,525	709 E	866 W	
99	25 Feb 53	II	B-R	BAL	None	77	XM-289/1	889.0	5.2	-7.1	--	--	--	29,590	27,527	182 E	275 E	
100	25 Feb 53	II	B-R	SAN	GM	77	R&D/1	400.2	9.9	2.9	--	--	--	19,862	19,527	181 E	79 W	
101	27 Feb 53	II	B-R	BAL	None	77	XM-289/1	400.0	6.1	-11.4	--	--	--	19,632	18,795	979 W	384 W	
102	2 Mar 53	II	B-R	BAL	None	77	XM-289/1	889.0	-4.9	-10.2	--	--	--	30,943	27,362	843 W	843 W	
103	5 Mar 53	II	B-R	BAL	None	77	XM-289/1	889.0	0	0	--	--	--	29,769	27,577	1976 E	770 E	
104	6 Mar 53	II	B-R	BAL	VT	77	XM-289/1	195.5	5.2	0.8	--	--	--	7,851	7,707	48 E	154 W	Short-Range Firing
105	12 Mar 53	II	B-R	BAL	None	77	XM-289/1	622.0	-9.8	-5.0	--	--	--	26,751	24,623	380 W	331 W	
106	13 Mar 53	II	B-R	BAL	None	77	XM-289/1	622.0	4.9	-8.7	--	--	--	26,142	24,560	891 W	592 W	
107	13 Mar 53	II	B-R	BAL	None	77	XM-289/1	622.0	0	-26.4	--	--	--	26,277	24,534	3404 W	1364 W	
108	14 Mar 53	II	B-R	BAL	None	77	XM-289/1	622.0	16.6	10.5	--	--	--	24,841	24,535	983 E	813 W	
109	20 Mar 53	II	B-R	BAL	VT	77	XM-289/1	400.0	-21.7	-7.5	--	--	--	20,998	18,579	227 W	52 E	
110	21 Mar 53	II	B-R	BAL	VT	77	XM-289/1	400.0	5.7	-10.7	--	--	--	20,082	19,160	880 W	369 W	Spin rkt malfunction
111	21 Mar 53	II	B-R	BAL	VT	77	XM-289/1	400.0	-4.2	-11.7	--	--	--	19,768	18,324	1269 W	666 W	
112	21 Mar 53	II	B-R	BAL	None	77	XM-289/1	889.0	-0.1	-34.6	--	--	--	29,132	27,023	4348 W	403 W	Spin rkt malfunction
113	23 Mar 53	II	B-R	CHEM	PIC	77	XM-289/1	400.0	0	0	--	--	--	19,894	18,959	816 E	663 E	
114	24 Mar 53	II	B-R	CHEM	PIC	77	XM-289/1	400.0	-4.0	5.7	--	--	--	19,781	18,344	256 E	332 W	
115	27 Mar 53	II	B-R	BAL	None	77	R&D/1	195.4	-6.5	6.6	--	--	--	9,176	8,168	19 W	227 W	Short-Range Firing
116	27 Mar 53	II	B-R	BAL	None	77	R&D/2	195.4	-6.9	1.1	--	--	--	10,165	9,031	150 E	106 E	Short-Range Firing
117	24 Apr 53	II	B-R	SAN	GM	100	R&D/1	890.0	-2.1	-8.7	--	--	--	30,106	28,230	1143 W	291 W	
118	24 Apr 53	II	B-R	SAN	GM	100	R&D/2	890.2	1.3	-5.8	--	--	--	30,283	28,534	798 W	271 W	
119	27 Apr 53	II	B-R	CHEM	PIC	77	R&D/1	400.7	-0.8	-7.0	13,463	11,360	5,500	--	--	--	--	
120	27 Apr 53	II	B-R	CHEM	PIC	77	R&D/2	623.2	-1.1	-7.3	24,067	21,786	6,000	--	--	--	--	
121	1 May 53	II	B-R	CHEM	PIC	77	R&D/2	623.2	-2.8	-19.7	N.A.	N.A.	N.A.	--	--	--	--	
122	4 May 53	II	B-R	IH	PIC	77	R&D/1	400.6	-3.4	9.4	17,863	15,108	1,894	--	--	--	--	
123	5 May 53	II	B-R	IH	PIC	77	R&D/1	400.6	-1.6	4.2	18,084	16,959	2,028	--	--	--	--	
124	6 May 53	II	B-A	MH	PIC	77	R&D/1	400.6	-1.1	-4.0	17,740	15,698	2,879	--	--	--	--	
125	25 May 53	II	B-R	CHEM	PIC	77	R&D/1	400.3	-10.0	-8.7			Excessive	--	--	--	--	
126	25 May 53	II	B-R	CHEM	PIC	77	R&D/2	399.2	-13.9	-1.7	N.A.	N.A.	N.A.	--	--	--	--	
127	26 May 53	II	B-R	SAN	GM	100	R&D/1	888.8	0.9	-2.0	--	--	--	31,780	28,474	423 W	246 W	
128	26 May 53	II	B-R	SAN	GM	100	R&D/2	891.2	-1.5	-3.7	--	--	--	31,245	28,471	886 W	204 W	
129	9 Jun 53	II	B-R	IH	PIC	77	R&D/1	400.3	0	0	17,825	16,595	2,281	--	--	--	--	
130	12 Jun 53	II	B-R	SAN	GM	100	R&D/1	400.3	0.5	-3.9	--	--	--	21,593	19,719	409 W	69 W	
131	12 Jun 53	II	B-R	SAN	GM	100	R&D/2	399.7	-0.4	-4.5	--	--	--	21,570	19,903	434 W	43 W	

TABLE II. HONEST JOHN DATA SUMMARY CHART (010 GRAIN) - Continued

HISTORICAL		MATERIEL					LAUNCH CONDITIONS				AIR BURST			GROUND IMPACT				MISCELLANEOUS
Rd. No.	Firing Date	Msl Type	Motor Source	Type Whd	Type Fuze	Grain Temp. (°F)	Lchr Type/No.	Lchr QE (mils)	Surface Wind Range (mph)	Surface Wind Cross (mph)	Distance Actual (yds)	Distance Stripped (yds)	Altitude Actual (ft)	Range Actual (yds)	Range Stripped (yds)	Deflection Actual (yds)	Deflection Stripped (yds)	REMARKS
132*	20 Jun 53	II	B-R	BAL	None	77	R&D/1	620.6	4.0	-4.1	--	--	--	26,244	24,503	373 W	85 W	
133*	20 Jun 53	II	B-R	BAL	None	77	R&D/2	623.5	5.2	-3.7	--	--	--	26,008	24,217	382 W	52 W	
134*	22 Jun 53	II	B-R	BAL	None	77	R&D/1	621.0	1.4	0.9	--	--	--	26,226	24,433	45 E	188 W	
135*	22 Jun 53	II	B-R	BAL	None	77	R&D/2	623.6	0	0	--	--	--	26,598	24,661	17 E	37 W	
136*	23 Jun 53	II	B-R	BAL	None	77	R&D/1	621.1	-3.4	-2.2	--	--	--	26,650	24,609	447 W	338 W	Spin rkt malfunction
137*	23 Jun 53	II	B-R	BAL	None	77	R&D/2	623.6	-2.6	-1.9	--	--	--	26,609	24,571	459 W	308 W	Spin rkt malfunction
138*	25 Jun 53	II	B-R	BAL	None	77	R&D/1	621.5	-5.1	-3.3	--	--	--	26,908	24,624	360 W	134 W	
139*	25 Jun 53	II	B-R	BAL	None	77	R&D/2	623.2	-4.8	-6.6	--	--	--	26,824	24,541	305 W	363 E	
140*	26 Jun 53	II	B-R	BAL	None	77	R&D/1	620.3	-6.5	-4.5	--	--	--	26,897	24,415	644 W	271 W	Spin rkt malfunction
141*	26 Jun 53	II	B-R	BAL	None	77	R&D/2	623.2	-9.3	-1.8	--	--	--	26,879	24,344	144 W	8 W	
142*	27 Jun 53	II	B-R	BAL	None	77	R&D/1	621.2	-0.3	-0.6	--	--	--	26,687	24,651	107 E	21 W	
143*	27 Jun 53	II	B-R	BAL	None	77	R&D/2	622.8	0	0	--	--	--	26,829	24,821	55 W	178 W	
144*	27 Jun 53	II	B-R	BAL	None	77	R&D/1	622.2	-11.1	-1.0	--	--	--	27,084	24,569	79 W	221 W	
145*	27 Jun 53	II	B-R	BAL	None	77	R&D/2	622.8	-9.4	-2.5	--	--	--	27,168	24,677	233 W	123 W	
146*	27 Jun 53	II	B-R	BAL	None	77	R&D/1	621.0	-8.6	-0.1	--	--	--	26,953	24,581	175 W	423 W	Spin rkt malfunction
147*	27 Jun 53	II	B-R	BAL	None	77	R&D/2	622.8	-3.3	4.7	--	--	--	27,015	24,844	490 E	213 W	
148*	29 Jun 53	II	B-R	BAL	None	77	R&D/1	621.5	0	0	--	--	--	25,929	24,019	173 E	353 E	
149*	29 Jun 53	II	B-R	BAL	None	77	R&D/2	623.1	3.5	-1.0	--	--	--	26,929	25,134	92 W	277 E	
150*	29 Jun 53	II	B-R	BAL	None	77	R&D/1	621.0	-4.3	6.3	--	--	--	26,762	24,718	473 E	80 W	
151*	29 Jun 53	II	B-R	BAL	None	77	R&D/2	623.0	-5.0	4.9	--	--	--	26,925	24,779	131 E	155 W	
152	14 Jul 53	II	B-R	IH	PIC	77	R&D/1	400.5	6.5	2.8	17,304	16,729	2,347	--	--	--	--	
153	22 Jul 53	II	B-R	SAN	GM	77	R&D/1	620.5	-4.7	1.8	--	--	--	27,634	25,474	516 E	348 E	
154	12 Aug 53	II	B-R	SAN	GM	100	R&D/1	400.7	-11.9	7.4	--	--	--	21,862	19,328	921 E	368 E	Spin rkt malfunction
155	12 Aug 53	II	B-R	SAN	GM	100	R&D/2	400.2	-11.2	12.4	--	--	--	21,903	19,427	534 E	413 W	Spin rkt malfunction
156	17 Aug 53	I	B-R	BAL	VT	77	XM-290/1	389.6	-10.7	-4.0	--	--	--	19,675	18,146	62 E	176 W	Spin rkt malfunction
157	18 Aug 53	II	B-R	IH	None	77	R&D/2	399.4	0	0	17,292	16,449	3,540	--	--	--	--	
158	28 Aug 53	II	B-R	SAN	GM	77	XM-289/2	622.8	6.7	-14.1	--	--	--	27,202	25,324	1386 W	85 E	
159	28 Aug 53	II	B-R	SAN	GM	77	XM-290/1	622.8	8.8	-11.7	--	--	--	27,206	25,551	1586 W	365 W	
160	1 Sep 53	II	B-R	MH	PIC	77	XM-289/2	622.8	-8.7	2.3	25,374	23,182	5,042	--	--	--	--	
161	1 Sep 53	II	B-R	MH	PIC	77	R&D/2	623.2	-1.0	0.1	24,961	23,172	3,276	--	--	--	--	
162	4 Sep 53	II	B-R	SAN	GM	40	R&D/1	888.9	6.7	4.8	--	--	--	30,762	28,440	1775 E	579 E	
163	4 Sep 53	II	B-R	SAN	GM	40	R&D/2	890.4	-5.0	7.6	--	--	--	30,619	28,180	1392 E	134 W	
164	10 Sep 53	III	B-R	BAL	None	77	R&D/1	621.4	0.9	4.4	--	--	--	26,504	24,961	633 E	78 E	
165	10 Sep 53	III	B-R	BAL	None	77	R&D/2	623.1	-1.9	-2.6	--	--	--	26,729	24,513	175 W	84 E	
166	15 Sep 53	III	B-R	BAL	None	40	R&D/1	399.4	2.7	4.2	--	--	--	19,805	18,263	126 E	172 W	(166) SRM - Wind data
167	16 Sep 53	II	B-R	SAN	GM	40	R&D/1	400.8	1.5	6.6	--	--	--	20,421	18,729	441 E	3 W	fr AN/MMQ-1 Set only.
168	16 Sep 53	II	B-R	SAN	GM	40	R&D/2	399.9	-0.2	3.0	--	--	--	21,075	19,273	88 E	72 W	
169	23 Sep 53	III	B-R	BAL	None	77	R&D/1	620.6	-11.7	-0.1	--	--	--	27,144	24,690	351 E	270 E	
170	23 Sep 53	III	B-R	BAL	None	77	R&D/2	625.0	-12.7	-3.0	--	--	--	27,361	24,748	28 W	199 E	
171	25 Sep 53	I	B-R	BAL	VT	77	R&D/2	196.4	0	0	--	--	--	9,471	8,839	80 W	91 W	Spin rkt malfunction
172	29 Sep 53	II	B-R	CHEM	PIC	77	XM-290/1	398.8	--	--	--	--	--	--	--	--	--	
173	2 Oct 53	II	B-R	SAN	GM	40	R&D/1	400.4	0	0	--	--	--	20,388	18,763	65 E	83 E	
174	2 Oct 53	II	B-R	SAN	GM	40	R&D/2	399.4	-5.4	-1.1	--	--	--	20,419	18,774	79 W	44 E	
175	5 Oct 53	I	B-R	BAL	VT	77	R&D/1	194.6	0	0	--	--	--	8,576	8,674	11 E	9 E	
176	5 Oct 53	I	B-R	BAL	VT	77	R&D/2	196.0	-4.5	0.2	--	--	--	8,170	7,378	9 E	6 W	
177	5 Oct 53	II	B-R	CHEM	PIC	77	XM-290/1	394.5	-4.7	2.2			Excessive	--	--	--	--	
178	13 Oct 53	II	B-R	SAN	GM	77	R&D/1	620.8	0.8	-13.7	--	--	--	27,081	25,186	1206 W	319 W	

* Special Accuracy Firings.

TABLE II. HONEST JOHN DATA SUMMARY CHART (010 GRAIN) - Continued

HISTORICAL		MATERIEL					LAUNCH CONDITIONS				AIR BURST			GROUND IMPACT				MISCELLANEOUS
									Surface Wind		Distance		Altitude	Range		Deflection		
Rd. No.	Firing Date	Msl Type	Motor Source	Type Whd	Type Fuze	Grain Temp. (°F)	Lchr Type/No.	Lchr QE (mils)	Range (mph)	Cross (mph)	Actual (yds)	Stripped (yds)	Actual (ft)	Actual (yds)	Stripped (yds)	Actual (yds)	Stripped (yds)	REMARKS
179	13 Oct 53	II	B-R	SAN	GM	77	R&D/2	623.8	2.6	-12.7	--	--	--	27,302	25,402	2033 W	1258 W	SRM - Fin hit lchr
180	22 Oct 53	I	B-R	BAL	VT	77	R&D/1	195.2	5.3	1.1	--	--	--	7,846	7,790	222 E	183 E	Short-Range firing
181	3 Nov 53	II	B-R	MH	PIC	77	XM-289/2	399.0	-0.9	1.8	18,340	17,077	1,330	--	--	--	--	Spin rkt malfunction
182	3 Nov 53	II	B-R	MH	PIC	77	R&D/2	398.9	0.5	2.0	18,171	17,138	1,214	--	--	--	--	
183	17 Nov 53	II	B-R	MH	PIC	77	XM-289/2	888.9	N.A.	N.A.	28,900	--	4,429	--	--	--	--	Surf Wind data N.A.
184	17 Nov 53	II	B-R	MH	PIC	77	R&D/2	890.9	-0.5	0.9	28,567	26,315	3,970	--	--	--	--	
185	20 Nov 53	II	B-R	CHEM	PIC	77	XM-290/1	888.9	N.A.	N.A.	--	--	--	--	--	--	--	(185) Fin failure
186	9 Dec 53	II	B-R	MH	PIC	77	XM-289/2	399.8	11.7	6.2	16,069	16,158	2,780	--	--	--	--	after burnout
187	10 Dec 53	II	B-R	CHEM	PIC	77	XM-290/1	399.8	0.3	0.1	14,394	12,936	4,706	--	--	--	--	(187) Lchr jack dam-
188	16 Dec 53	II	B-R	MH	PIC	40	XM-289/2	459.0	--	--				Fired Up-Range				aged by blast
189	18 Dec 53	II	B-R	BAL	VT	77	XM-289/2	888.9	0.7	0.6	--	--	--	28,720	26,491	346 E	153 W	
190	12 Jan 54	II	B-R	BAL	None	77	XM-289/2	888.9	-7.6	0	--	--	--	31,258	28,183	2599 E	1636 E	
191	15 Jan 54	I	B-R	BAL	None	20	R&D/1	619.9	N.A.	N.A.	--	--	--	20,671	N.A.	403 E	N.A.	(191) Fin #3 failure
192	15 Jan 54	I	B-R	BAL	None	20	R&D/2	623.6	N.A.	N.A.	--	--	--	24,807	23,627	524 E	206 E	at 2 seconds
193	20 Jan 54	II	B-R	MH	PIC	77	R&D/2	398.2	-22.0	1.1	17,800	14,536	4,200	--	--	--	--	

EXPLANATORY NOTES

MOTOR DATA

B-A.... Motor manufactured by Burnham Corp.; loaded by Allegany Ballistics Laboratory.

B-R.... Motor manufactured by Burnham Corp.; loaded by Radford Arsenal.

WARHEAD DATA

BAL.... Nominal 1500-pound concrete ballast.

SAN.... Warhead components by Sandia Corporation.

IH..... Nominal 1500-pound warhead components by International Harvester Corporation.

PIC.... Nominal 1500-pound warhead components by Picatinny Arsenal.

MH..... Nominal 1500-pound warhead components by Minneapolis-Honeywell Corporation.

CHEM... Nominal 1500-pound warhead components by Chemical Corps, U. S. Army.

FUZING DATA

VT..... Variable time proximity fuze by National Bureau of Standards (includes antenna for signal transmission and reception).

GM..... Time fuze developed by General Mills Corporation.

FRK.... Time fuze developed by Frankford Arsenal.

PIC.... Either impact fuze or time fuze - both developed by Picatinny Arsenal.

GENERAL DATA

N.A. ... Not Available.

QE..... Quadrant Elevation

SRM..... Spin rocket malfunction

E..... East of Target

W..... West of Target

Excessive - Actual air burst altitude was in excess of standard summit altitude. Air burst positions for these rounds were not stripped.

Winds from North and from East are considered positive (i.e., head winds and winds from the right).

LAUNCHER DATA

R&D..... Research and Development Launchers. Stationary, mounted in concrete. Installed at a fixed nominal azimuth, North; elevation angle could be set only at various nominal angles.

XM-289.. Tactical, self-propelled launchers - Rock Island Arsenal.

XM-290.. Tactical, trailer-mounted launcher - Douglas Aircraft Company.

(U) BIBLIOGRAPHICAL NOTE

In the preparation of this volume, the author researched voluminous records in six different collections: (1) the Honest John R&D case files assembled and retired by elements within the Redstone Arsenal complex; (2) the Honest John project files assembled and retired by the Rocket Branch, R&D Division, OCO—generally referred to as the ORDTU Files; (3) a selection of historical reports and diaries in the AMSC Historian's files; (4) a wide range of documents (feasibility and engineering study reports, contractor proposals, Ordnance Technical Committee minutes, etc.) assembled in the Redstone Scientific Information Center; (5) historical studies and reports, copies of supporting documents, and other project materials in the Historical Division files, AMICOM; and (6) miscellaneous documents in the current files of the Honest John Commodity Office, AMICOM.

The Honest John R&D case files embrace about 19 linear feet of classified and unclassified documents, dating back to 1950. These records are currently stored in the Records Holding Area under the custody of the Records Management Officer, Adjutant Division, U. S. Army Missile Support Command, but will eventually be transferred to the U. S. Army Records Center in St. Louis, Missouri. They include a wide range of material on all phases and facets of the Honest John project—official and personal communications; teletypes; minutes of important conferences and briefings; travel reports; test reports; copies of contracts; periodic progress and status reports; and personal notes of project administrators reflecting candid observations and impressions concerning specific events, actions, problems, etc. Though complete in most respects, these files are not systematically arranged and properly labeled for ready reference, and they generally contain an inordinate number of duplications. This is particularly true of the files covering the 1950 - 55 period.

The ORDTU project files generated within the Office, Chief of Ordnance, comprise a valuable set of documents (letters, memoranda, conference minutes, progress reports, etc.) reflecting program policies

and decisions at top management levels, as well as a running account of significant events, actions, and problems. Two boxes of these records were borrowed from the Federal Records Center, Region 3, General Services Administration, in Alexandria, Virginia.

Records located in the AMSC Historian's files embraced about 4 linear feet of historical reports and diaries generated by Redstone Arsenal organizations during the 1950 - 58 period. Though not used extensively, these records proved useful in filling in gaps and in verifying certain facts, figures, and dates. This particular block of records has since been transferred from AMSC Headquarters to the Records Holding Area, AMSC, for storage and eventual retirement to the U. S. Army Records Center in St. Louis, Missouri.

Of the documents researched in the other three collections, some proved especially useful in rounding out the summary of project activities conducted at distant installations. Among these were the following historical monographs:

> Niel M. Johnson and Leonard C. Weston, "Development and Production of Rocket Launchers at Rock Island Arsenal, 1945 - 1959," (2 vols., Hq Army Weapons Command, Rock Island, Ill., August 1962).
>
> Eunice H. Brown, et al., "Development & Testing of Rockets & Missiles at White Sands Proving Ground, 1945 - 1955," (WSMR, 1 October 1959).
>
> William R. Stevenson, et al., "Development & Testing of Rockets & Missiles at White Sands Missile Range, 1956 - 1960," (WSMR, 27 July 1961).

Supplementary to the mass of written records is the information collected through interviews with persons intimately associated with the Honest John project from its inception. The information assembled through this medium not only filled in gaps and solved obvious conflicts and errors in the records, but also gave the author an invaluable in-depth perception of the written word.

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(U) GLOSSARY OF ABBREVIATIONS

-A-

ABL--Allegany Ballistics Laboratory
ABMA--Army Ballistic Missile Agency
ACofOrd--Assistant Chief of Ordnance
ACofS--Assistant Chief of Staff
Act--Acting
Actv(s)--Activate, Activities
Actvn--Activation
AEC--Atomic Energy Commission
AFF--Army Field Forces
AFSWP--Armed Forces Special Weapons Project
Agmt--Agreement
Aloc--Allocate
Alocn--Allocation
AMCTC--Army Materiel Command Technical Committee
AMFCo--American Machine and Foundry Company
AMICOM--Army Missile Command
Ammo--Ammunition
AMSC--Army Missile Support Command
Amt--Amount
AOMC--Army Ordnance Missile Command
APG--Aberdeen Proving Ground
Appr--Approve, Approved, Approval
ARGMA--Army Rocket and Guided Missile Agency
Arty--Artillery
ASA--Assistant Secretary of the Army
Asgmt--Assignment
Assoc--Associate
Asst--Assistant
Assy--Assembly
Atch--Attach (-ed)
Auth--Authority, Authorize, Authorization
Aval--Available
Awd--Award

-B-

Br--Branch
BRL--Ballistic Research Laboratories
Btry(s)--Battery, Batteries
Btwn--Between
BuOrd--Bureau of Ordnance

-C-

C--Confidential
Cal--Caliber
Cen--Center
CG--Commanding General
Chap--Chapter

Chf--Chief
Chmn--Chairman
Clas--Classify, Classification
CMH--Chief of Military History
Cmt--Comment
CO--Commanding Officer
Co--Company
CofOrd--Chief of Ordnance
Com--Committee, Commission
Comdr--Commander
Condg--Conditioning
Conf--Conference
Contr--Contract
Coord--Coordination
Corp--Corporation
CPE--Circular Probable Error
CPFF--Cost Plus Fixed Fee
Crs--Course
CSigO--Chief Signal Officer
CY--Calendar Year

-D-

DA--Department of the Army
DAC--Douglas Aircraft Company
DCSLOG--Deputy Chief of Staff for Logistics
Dep--Deputy
Dev--Development
DF--Disposition Form
Dir--Director, Directive
Dist--District
Div--Division
Delvry--Delivery
DN--Department of the Navy
DOA--Department of Army
Doc(s)--Document(s)
DOD--Department of Defense
Dpl--Deploy
Dplmt--Deployment
Dwg--Drawing

-E-

Elec--Electric
Engr--Engineer (-ing)
Equip--Equipment
Est--Estimate, Estimated

-F-

F.--Fahrenheit
FA--Frankford Arsenal
FAB--Field Artillery Battalion
Fab--Fabricate, Fabrication
Fac--Facility, Facilities

FAG--Field Artillery Group
FC--Field Command
Feas--Feasibility
Fld--Field
Flt--Flight
Fol--Following
FONECON--Telephone Conversation
FOUO--For Official Use Only
FP--Fixed Price
FRC--Federal Records Center
FS--Feasibility Study
Ft--Feet, Fort
Fxd--Fixed
FY--Fiscal Year

-G-

GB--Gas Bacteriological
GECo--General Electric Company
Gen--General
GM--Guided Missile
Gnd--Ground
GO--General Order
Gp--Group
GS--General Staff
GSA--General Services Administration

-H-

Hdlg--Handling
HE--High Explosive
Hist--History, Historical
HJ--Honest John
HPCo--Hercules Powder Company
Hq--Headquarters

-I-

Inc--Increase, Incorporated
Incl--Inclosure
Ind--Industrial, Indorsement
Inf--Infantry
Info--Information
Inst--Instrument
Instr--Instruct, Instruction, Instructor
Intvw--Interview

-J-

JATO--Jet-Assisted-Take-Off
JPL--Jet Propulsion Laboratory

-L-

LAA--Los Angeles Area
Lab--Laboratory

LAOD--Los Angeles Ordnance District
Lb--Pound
Lchg--Launching
Lchr--Launcher
LJ--Littlejohn
LO--Letter Order
Lt--Light
Ltr--Letter

-M-

Mat--Materiel, Material
MC's--Military Characteristics
Meas--Measure, Measuring
Memo--Menorandum
Met--Meteorological
Mfg--Manufacture, Manufacturing
MFR--Memorandum For Record
Min--Minutes, Minimum
MIPR--Military Interdepartmental Purchase Request
mm--millimeter
Mod--Model, Modification
MRB--Military Records Branch
Msl--Missile
MSP--Missile System Plan
Mtg--Meeting

-N-

NBS--National Bureau of Standards
No.--Number
Nomen--Nomenclature
NYOD--New York Ordnance District

-O-

OAC--Ordnance Ammunition Command
Obj--Objective
OCAFF--Office of the Chief of Army Field Forces
OCM--Ordnance Committee Minutes
OCO--Office of the Chief of Ordnance
OCofS--Office of the Chief of Staff
OCSigO--Office of the Chief Signal Officer
Ofc--Office
OML--Ordnance Missile Laboratories
Opns--Operations
ORC--Ordnance Rocket Center
Ord--Ordnance
ORDFI--Requirements Branch, Field Service Division
ORDFQ--Central Supply Branch, Field Service Division
ORDGA--Office Service Branch, Executive Office
ORDID--Industrial Operations Branch, Industrial Division
ORDIM--Ammunition Branch, Industrial Division
ORDIX--Industrial Division

ORDTA--Artillery Ammunition Branch, Research and Development Division
ORDTB--Research & Materials Branch (later Research Branch)
ORDTU--Rocket Branch, Research and Development Division
ORDTX--Research and Development Division
Orien--Orientation
Orig--Origin
OST--Operational Suitability Test

-P-

PA--Picatinny Arsenal
Pam--Pamphlet
Pdn--Production
PE--Probable Error
Pers--Personnel
Ph--Phase
PHOD--Philadelphia Ordnance District
Pic--Picatinny
PO--Purchase Order
PR--Purchase Request
Pri--Priority
Proc--Procure, Procurement
Prog--Progress, Program
Proj--Project
Prop--Propellant
Ptbl--Portable
Pur--Purchase

-Q-

QE--Quadrant Elevation
Qtrly--Quarterly

-R-

RA--Radford Arsenal
RAD--Research and Development (Fund Order)
R&D--Research and Development
RDB--Research and Development Board
RDD--Research and Development Division
Rd--Round
Recm(d)--Recommend (-ed)
Recmn--Recommendation
Ref--Reference
Rept--Report
Req--Request
Reqn--Requisition
Rev--Revise, Revision
RHA--Records Holding Area
RIA--Rock Island Arsenal
Rkt--Rocket
ROO--Resident Ordnance Officer
ROTCM--Reserve Officers' Training Corps Manual
rps--revolutions per second

RSA--Redstone Arsenal
Rsch--Research
RSIC--Redstone Scientific Information Center
Rspv--Respective (-ly)
Rst--Redstone
Rqrmt--Requirement

-S-

S--Secret
Scd--Schedule
Sec--Section
SECDEF--Secretary of Defense
Secy--Secretary
SO--Special Order
SP--Self-Propelled
Sp--Special
Spec--Specification
SPIA--Solid Propellant Information Agency
Spt--Support
Std--Standard
Stdzn--Standardization
Stmt--Statement
Sub--Subject
Sum--Summary
Suppl--Supplement
Supv--Supervise, Supervision
Sur--Surface
Svc--Service
Sys--System

-T-

T&E--Technical and Engineering
Tech--Technical
Temp--Temperature
Tlr--Trailer
Tng--Training
TT--Teletype
Tvl--Travel

-U-

U--Unclassified
Univ--University
Unk--Unknown
USA--United States Army

-V-

Vol--Volume

-W-

Whd--Warhead
WSMR--White Sands Missile Range

WSPG--White Sands Proving Ground
Wt--Weight

-Y-

Yd--Yard

INDEX